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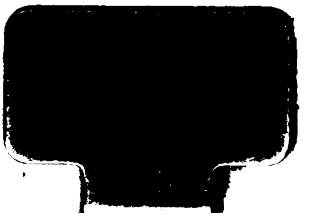

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REPORT

ON

EXPERIMENTS MADE WITH THE BASHFORTH CHRONOGRAPH.

TO DETERMINE

THE RESISTANCE OF THE AIR TO THE MOTION OF ELONGATED PROJECTILES.

(PART II.)

1878–79.

LONDON:
PRINTED FOR HER MAJESTY'S STATIONERY OFFICE.
BY HARRISON & SONS,
PRINTERS TO THE QUEEN AND TO HER MAJESTY.

1879.

[C.2231.] Price 10d.

A PROTEST.

Reports on Experiments made with the Bashforth Chronograph to determine the Resistance of the Air to the Motion of Projectiles 1865-1870, (84/B/1941), were published in 1870, and the Final Report on Experiments 1878-1880, (84/B/2909), in 1880, which contained Coefficients of Resistance for Ogival-headed Shot for velocities between 100 and 2800 feet per second, or, between 30 and 853 metres per second, and two General Tables connecting Velocity (1) with Time, and (2) with Space.

IN THE FOLLOWING YEAR M. KRUPP PUBLISHED

"Table de Krupp pour le calcul des vitesses restantes "horizontales et des durées de trajet des projectiles oblongs. "Essen 1881."

These Tables of M. Krupp are the same in substance as my General Tables, substituting French for English measures. They differ only in supposing a slightly reduced resistance of the air due to a more acutely pointed shot, &c., to the extent shewn in the accompanying Diagram, or, in a similar Diagram given by Professor Greenhill in the Proceedings of the R.A. Institution, Woolwich, Aug., 1884, p. 60. M. Krupp makes no reference to the results obtained by any prior experimenter.

I desire to direct particular attention to the fact that an intermediate Report of mine, dated July 8, 1879, was printed and circulated in 1879 (84/B/2853), of which I received 100 copies. That Report gave coefficients extending from velocity 430 to 2250 feet per second, or from velocity 131 *to* 685 *metres per second, while M. Krupp's Tables extend from velocity* 140 *to* 700 *metres per second.*

Having devoted much time and labour (1864-1880) in carrying out ballistic experiments at Woolwich and Shoeburyness, I object to have results very similar to mine laid before the public as perfectly independent discoveries. I have no claim to make to anything beyond what was contained in my Reports to Government, and published before the Experiments of M. Krupp are said to have been made.

F. BASHFORTH,
Late Professor of Applied Mathematics to the Advanced Class of Royal Artillery Officers, Woolwich.

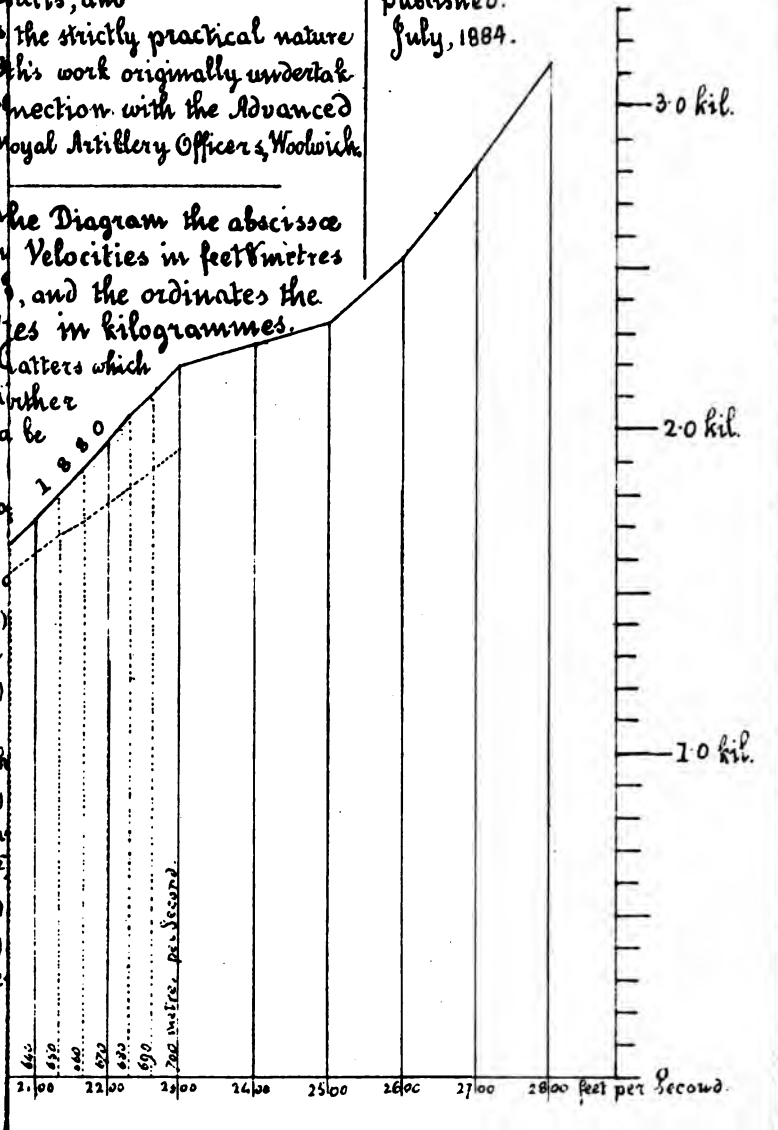
MINTING VICARAGE,
HORNCASTLE, *Dec.*, 1884.

...in kilogrammes per square centimètre of cross sec... sur le calcul des Vitesses restantes horizontales et des... of Air = 526·97 grains.

Bash... publication is valuable as ... Space ... ing Bashforth's previously pub... Ogival... ults, and ... results ... the strictly practical nature ... 7 and 9 ... his work originally undertak... 1867, 186... nection with the Advanced ... perfor... oyal Artillery Officers, Woolwich. ... volved ...

graph... he Diagram the abscissæ ... be don... Velocities in feet & metres ... I ..., and the ordinates the ... in 1867... es in kilogrammes. ... with ... atters which ... al-hea... rther ... goofs. ... be ... lished ... of velo... (1) ... Sound... (2) ... tion ... (3) ... tion ... and th... (4) ... factu... (40185/18) ... (5) ... (6) ... Slade...

Supplement to the "Motion of Projectiles" shortly to be published.
July, 1884.



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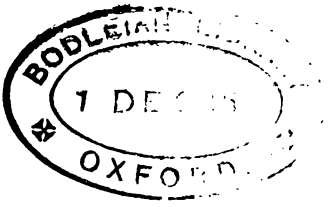

REPORT

ON

EXPERIMENTS MADE WITH THE BASHFORTH CHRONOGRAPH.

TO DETERMINE

THE RESISTANCE OF THE AIR TO THE MOTION OF ELONGATED PROJECTILES.

(PART II.)

1878–79.

LONDON:
PRINTED FOR HER MAJESTY'S STATIONERY OFFICE,
BY HARRISON & SONS,
PRINTERS IN ORDINARY TO HER MAJESTY.

1879.

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REPORT VIII.

MINTING VICARAGE, HORNCASTLE,
July 8, 1879.

SIR,

THE experiments made with the Bashforth Chronograph in 1867–68, to determine the resistance of the air to the motion of projectiles, showed that this resistance to similarly shaped shot varied as the squares of their diameters, but that the resistance to a given shot did not vary according to any simple power of the velocity. The most convenient form in which the resistance could be expressed was found to be $2b'v^3$, where v is the velocity of the shot expressed in feet per second, and b' is a coefficient which generally varies slowly with v. Tables of corresponding values of v and b' were derived from experiments made with spherical shot, between velocities 850 and 2150 f. s.; and with elongated ogival-headed projectiles, between velocities 900 and 1700 f. s. At that time this velocity of 1700 f. s. was considered to be sufficiently high for all practical purposes. The experiments stopped at a velocity about 900 f. s., because the trajectory became much curved, and the results obtained with screens 150 feet apart were not satisfactory for lower velocities. The reports of these and some other experiments made with the same chronograph were printed and published in 1870* (84/B/1941).

In 1877 it was decided to continue these experiments with ogival-headed shot moving at *low* velocities. The screens were placed 75 feet apart, instead of 150 feet as before. They were 16 in number, instead of 10 as before, many of them being much higher. The threads of the screens were placed one inch apart, instead of two inches. All these changes greatly increased the labour and difficulty in carrying out the experiments with low velocities.

As the resistance of the air had been found to vary as the square of the diameter of the shot in the former experiments, it was decided to make use now of only one gun, rifled with a rapid twist in order to obtain steadiness in the shot fired with a low initial velocity, and also to obtain results corresponding to those which might be expected to be derived from the terminal motion of a shot fired with a high initial velocity from an ordinary service gun. The gun selected was the small 7 pr. R.M.L. gun, firing hollow shot of weights varying from 6·31 to 6·66 lbs. The

* Reports on Experiments made with the Bashforth Chronograph to determine the Resistance of the Air to the Motion of Projectiles, 1865–1870. London: W. Clowes and Son; Harrison and Sons; W. H. Allen and Co.; W. Mitchell; Longmans and Co.; Trübner and Co. Edinburgh: A. C. Black. Dublin: A. Thom and E. Ponsonby.

shot were 2·94 inches in diameter, but as the gas-check continued attached to the shot, d was taken equal 2·97 inches. Rounds 412–438 were fired through all the 16 screens. For rounds 439–448 the screens Nos. 10, 11, and 12 were left out. The heights at which the screens were cut were carefully noted after each round, so as to give the means for forming an average trajectory for each charge used. Thus the exact velocity could be obtained, because the chronograph gave the times between successive screens, and the average trajectory gave the spaces travelled over by the shot in those times. In order to obtain the resistance of the air to projectiles moving with still lower velocities, rounds 449–460 were fired from the 6·3-inch howitzer, the screens Nos. 6–11 having been removed. By interpolation, it was found at what times the projectiles were due at each screen, and then the times over the central screens, where the motion of the shot was nearly horizontal, were used in calculating the coefficient b'.

The chronograph was set up at Shoeburyness on the 18th of June, 1878, and experiments were carried on during the following three days, but with little success. In the first place, induced currents interfered with the working of the instrument. Then it was found that the shot 3 inches in diameter often passed between the threads only one inch apart without breaking one, and the gas-check sometimes left the shot in its flight. The rounds fired with 12 and 8 oz. charges were reduced. Some of the results were good, and some bad. The records obtained from rounds fired with 6 and 4 oz. were so defective that they could not be reduced with a prospect of any trustworthy result. The only way to proceed seemed to be to reject *all* these rounds rather than make a selection of what appeared to be good.

The screens were afterwards formed with sewing cotton instead of linen thread, but still, at low velocities, the 3-inch shot often passed through a screen without breaking a thread. It therefore seems desirable, in experiments with low velocities, that something should be attached to the front of the shot, which, while it did not sensibly affect the resistance of the air to the shot, would secure the breaking of the wires or threads of which the screens are composed. The whole of the subsequent rounds were reduced where possible, and the results have been stated in all cases in the following tables. It seemed desirable to reject two very defective rounds, 420 and 431, fired from the 3-inch gun, which appeared to give too high a resistance. Also, for the same reason, two rounds from the 6·3-inch howitzer, 455 and 460, were rejected, for they indicated a resistance much too great in comparison with other rounds. This may have arisen from some error or from great unsteadiness of the shot.

The lower the velocity of the shot the less the motion of the shot is affected by the resistance of the air. This, added to the increased curvature of the trajectory of the shot for low velocities, renders the correct determination of the resistance of the air a matter of great labour and difficulty at low velocities. A reference to Table III will show that the values of K_v for velocities below 550 f. s. cannot be considered to be conclusively determined because they depend upon so few rounds. The results have been given as they presented themselves, and they appear to agree with the more trustworthy results obtained with higher velocities. If these values of K_v may be relied upon, the resistance of the air varies as the *square* of the velocity for velocities 430 to 830 f. s., and as the *cube* of the velocity from 830 to 1000 f. s.

As the resistance of the air has only a slight effect upon heavy shot moving at low velocities, it is probable that, in this respect, all has been accomplished that is of practical utility.

In consequence of recent improvements in guns and powder, giving greatly increased muzzle velocities, it was thought desirable to determine the values of b' or K_v for all possible velocities above 1700 f. s. Rounds 461–463 and 470–482 with ogival-headed shot, rounds 464–466 with flat-headed shot, rounds 467–469 with hemispherical headed shot were fired from Armstrong's new 6-inch B.L. gun, through 12 equidistant screens (150 feet apart). These rounds gave values of K_v or b' for ogival-headed shot up to 2250 f. s. These values of K_v or b' appear to be continually tending to become constant as the velocity increases up to 2250 f. s. In default, therefore, of experiments with higher velocities, we may consider K_v to continue constant and equal $K_{2250} = 66{\cdot}6$ for all velocities of ogival-headed projectiles exceeding 2250 f. s. For suppose a shot fired with a muzzle velocity of 2500 f. s., this would be reduced in a very short interval of time below 2250 f. s. where the coefficient is known from actual experiment.

During some of these experiments, two Le Boulengé chronoscopes were used in addition, to measure the velocities of the shot at 150 and 1650 feet from the gun. The following are the results given by the two instruments :—

	No. of Round.									
	461	462	463	464	465	466	468	469	470	472
	f. s.	f. s.	f. s.	f. s.	f. s.	f. s.	f. s.	f. s.	f. s.	f. s.
Bashforth	1946	1935	1942	1905	1897	1890	1889	1912	1778	1754
Boulengé	1947	1928	1948	1907	1882	1880	1917	1912	1778	1755
Difference	+ 1	− 7	+ 6	+ 2	− 15	− 10	+ 28	0	0	+ 1
Bashforth	—	1701	1730	—	1489	1501	1626	1629	1596	—
Boulengé	1622	1702	—	—	—	—	1565	—	—	—
Difference		+ 1					− 61			

Complaints were made of the strange vagaries of the instruments during some of these experiments. Now the Bashforth Chronograph requires only one short galvanic circuit passing through the clock and chronograph, and one long circuit passing through all the screens, and no difficulty of the nature complained of has been experienced before. But the use of the two Le Boulengé instruments brought in four additional galvanic currents. The disturbance in the instruments must therefore have arisen from induced currents caused by the conducting wires having somewhere been too near together.

In the former experiments the value of b' was given in tables under the form $2000\, b' \frac{w}{d^2}$, but it has since been found more convenient to express it under the form $K_v = 2b' \frac{w}{d^2} \times (1000)^2$. Thus the employment of many useless decimal places is avoided, while the same significant digits are retained. The method of finding b' has been fully explained at pages 56 to 60 of the published Reports.

The values of b' obtained from the experiments of 1867–8, have been combined, as far as possible, with those of 1878–9.

All particulars respecting each round have been stated in Tables I and II.

In Tables III, V, VII and IX the values of K_v obtained from each round have been arranged under their proper velocity v; and from these the mean values of K_v have been obtained.

These mean values of K_v were then plotted, and corrections were applied, which were afterwards further adjusted by differencing. These results are given in Tables IV, VI, VIII and X.

Every possible assistance was given at Shoeburyness. Captain O'Callaghan, R.A., Assistant Superintendent of Experiments, or Captain White, R.A., then Second Assistant, took charge of the gun and screens. And Captain C. Jones, R.A., then Second Officer in the Experimental Branch of the Director of Artillery's Department, Captain Morley, R.A., Proof Officer, R.G.F., and Captain McClintock, R.A., Secretary to the Sub-Committee on Iron Plates, took charge of the chronograph, and read off the records, which were then sent to me for reduction. The experiments appear to have been carried out very carefully and successfully. The results with high velocities are quite conclusive. But the results with low velocities are not quite so satisfactory, because the rounds fired were not sufficiently numerous, and because the shot frequently passed through the screens without breaking a thread.

If further experiments with low velocities were to be undertaken, it would be advisable to place (1) from six to eight screens near the gun, at intervals of 37½ feet, in order to secure correct muzzle velocities; and (2) two canvas screens to secure the exact initial directions of the shot. Distant screens would have to be used to obtain the exact times of flight over known spaces.

The following is a copy of the Shoeburyness Meteorological Register for the days of experimenting:—

		Barometer.	Thermometer.	
			Wet.	Dry.
		inches.	Degrees F.	Degrees F.
1878.	September 13 ..	30·10	51	56
„	„ 25 ..	29·65	46	50
„	„ 26 ..	29·90	41	49
„	„ 27 ..	30·05	42	49
„	October 31 ..	29·80	37	38
„	November 1 ..	29·85	41	42
„	December 4 ..	30·15	35	37
„	„ 5 ..	30·05	33	35
1879.	March 5 ..	30·05	45	46
„	„ 6 ..	30·15	42	46
„	„ 7 ..	29·95	37	39
„	„ 10 ..	30·40	41	42
„	„ 11 ..	30·25	42	45
„	„ 12 ..	29·40	40	43

In the reduction of the experiments of 1867–68, the weight of a cubic foot of air was taken to be 530·6 grs., but these experiments have been reduced on the supposition that it weighs 534·22 grs., which is the weight of a cubic foot of dry air at 62° F. under a pressure of 30 inches of mercury. The old coefficients have therefore been increased in the ratio of 530·6 to 534·22, or, as 1 to 1·0068, or, they are increased by about the 2-300ths of their former value.

I have the honor to be,
SIR,
Your obedient Servant,
FRANCIS BASHFORTH,

Late Professor of Applied Mathematics to the Advanced Class, and Referee to the Late Ordnance Select Committee.

To Major-General F. A. Campbell, R.A., C.B.,
Director of Artillery and Stores,
Woolwich.

Report VIII.—Table I

Showing the Times of the Shot passing through the Screens.

(Shot with Ogival Heads).

Date of Experiment.	Weight of Shot = w.	Diameter of Shot = d.	Weight of Charge.	Number of Round.	Screens 75 feet apart.														
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1878	lbs.	inches	lbs. oz.		″	″	″	″	″	″	″	″	″	″	″	″	″	″	″	″
September 13	6·50	2·97	0 12	412	0·0000	0·0715	0·1438	0·2171	0·2912	0·3661	0·4418	0·5180	0·5950	0·6725	0·7505	0·8289	0·9077	0·9869	1·0664	1·1461
,,	6·50	,,	0 12	413	0·0000	0·0696	0·1399	0·2109	0·2825	0·3548	0·4277	0·5011	0·5751	0·6495	0·7245	0·7999	0·8759	0·9524	1·0293	1·1067
,,	6·50	,,	0 12	414	0·0000	0·0718	0·1442	0·2174	0·2912	0·3657	0·4407	0·5164	0·5925	0·6691	0·7462	0·8238	0·9019	0·9805	1·0596	
September 25	6·50	,,	0 10	415	0·0000	0·0781	0·1569	0·2363	0·3163	0·3969	0·4780	0·5597	0·6420	0·7250	0·8086	0·8928	0·9777	1·0633	1·1495	
,,	6·56	,,	0 10	416	0·0000	0·0760	0·1523	0·2289	0·3059	0·3832	0·4610	0·5393	0·6180	0·6973	0·7770	0·8573	0·9381	1·0196	1·1017	1·1844
,,	6·50	,,	0 10	417	0·0000	0·0759	0·1523	0·2292	0·3066	0·3844	0·4628	0·5417	0·6212	0·7012	0·7818	0·8630	0·9449	1·0275	1·1109	1·1950
,,	6·44	,,	0 10	418	0·0000	0·0788	0·1583	0·2384	0·3191	0·4005	0·4827	0·5656	0·6493	0·7336	0·8185	0·9040				
,,	6·50	,,	0 10	419	0·0000	0·0777	0·1557	0·2343	0·3132	0·3926	0·4725	0·5528	0·6336	0·7150	0·7969	0·8795	0·9627	1·0465	1·1309	
,,	6·50	,,	0 8	420	*0·0000*	*0·0808*	*0·1695*	*0·2451*	*0·3285*	*0·4198*	*0·4978*	*0·5836*								
,,	6·47	,,	0 8	421	0·0000	0·0831	0·1663	0·2496	0·3332	0·4171	0·5014	0·5862	0·6715	0·7574	0·8439	0·9312	1·0192	1·1082	1·1980	
,,	6·56	,,	0 8	422	0·0000	0·0817	0·1642	0·2473	0·3312	0·4157	0·5009	0·5866	0·6729	0·7596	0·8468	0·9342	1·0219	1·1099	1·1979	
,,	6·47	,,	0 8	423	0·0000	0·0847	0·1697	0·2549	0·3406	0·4265	0·5128	0·5994	0·6865	0·7740	0·8620	0·9506	1·0396	1·1292		
September 26	6·66	,,	0 6	424	0·0000	0·0967	0·1940	0·2919	0·3905	0·4897	0·5895	0·6899	0·7909	0·8924	0·9945	1·0971	1·2003	1·3041	1·4084	1·5133
,,	6·56	,,	0 6	425	0·0000	0·0943	0·1890	0·2842	0·3800	0·4762	0·5730	0·6704	0·7685	0·8672	0·9666	1·0667	1·1676	1·2692	1·3716	1·4749
,,	6·63	,,	0 6	426	0·0000	0·1026	0·2057	0·3095	0·4138	0·5187	0·6242	0·7304	0·8372	0·9447	1·0530	1·1622	1·2722	1·3831	1·4950	1·6079
,,	6·47	,,	0 6	427	0·0000	0·0920	0·1846	0·2776	0·3711	0·4650	0·5595	0·6544	0·7499	0·8459	0·9425	1·0396				
,,	6·63	,,	0 6	428	0·0000	0·0943	0·1891	0·2845	0·3803	0·4766	0·5734	0·6707	0·7686	0·8671	0·9660	1·0655	1·1655	1·2661	1·3672	1·4689
,,	6·47	,,	0 8	429	0·0000	0·0850	0·1705	0·2565	0·3430	0·4300	0·5175	0·6056	0·6943	0·7836	0·8735	0·9639	1·0550	1·1466	1·2389	
,,	6·47	,,	0 8	430	0·0000	0·0879	0·1763	0·2651	0·3545	0·4442	0·5345	0·6252	0·7163	0·8079	0·9000	0·9925	1·0854	1·1788	1·2728	1·3672
September 27	6·50	,,	0 4	431	*0·0000*	*0·0998*	*0·2009*	*0·3030*	*0·4060*	*0·5098*										
,,	6·63	,,	0 4	432	0·0000	0·1049	0·2102	0·3159	0·4222	0·5289	0·6363	0·7442	0·8527							
,,	6·56	,,	0 4	433	0·0000	0·1057	0·2122	0·3194	0·4274	0·5361	0·6456	0·7558	0·8667	0·9784	1·0908	1·2039	1·3178	1·4324	1·5477	
,,	6·63	,,	0 4	434	0·0000	0·1021	0·2050	0·3086	0·4129	0·5180	0·6238	0·7302	0·8374	0·9452	1·0538	1·1630	1·2728	1·3834	1·4946	
,,	6·56	,,	0 4	435	0·0000	0·1024	0·2056	0·3096	0·4144	0·5200	0·6264	0·7336	0·8416	0·9505	1·0601	1·1705	1·2817	1·3937	1·5065	1·6200

						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
,,	6·63	,,	0	4	436	0·0000	0·1076	0·2158	0·3248	0·4345	0·5450	0·6562	0·7682	0·8811	0·9947	1·1090	1·2240	1·3398	1·4562		
,,	6·63	,,	0	4	437	0·0000	0·1076	0·2159	0·3251	0·4350	0·5457	0·6572	0·7694	0·8824	0·9962	1·1108	1·2261	1·3422	1·4590	1·5766	
,,	6·63	,,	0	3	438	0·0000	0·1242	0·2496	0·3762	0·5038	0·6324	0·7619	0·8924	1·0237	1·1558	1·2887	1·4223	1·5565	1·6914		
October 31	6·31	,,	0	3	439	0·0000	0·1290	0·2588	0·3893	0·5206	0·6526	0·7855	0·9191	1·0535	1·1886	1·3246	1·4614	1·5990	1·7375	1·8769	2·0171
,,	6·34	,,	0	3	440	0·0000	0·1251	0·2508	0·3773	0·5044	0·6324	0·7611	0·8906	1·0209	1·1520	1·2840	1·4168	1·5505	1·6850	1·8204	1·9567
,,	6·31	,,	0	3	441	0·0000	0·1268	0·2544	0·3827	0·5119	0·6418	0·7724	0·9038	1·0359	1·1688	1·3023	1·4367	1·5717	1·7075	1·8440	1·9812
,,	6·53	,,	0	3	442	0·0000	0·1300	0·2609	0·3927	0·5255	0·6591	0·7937	0·9291	1·0656	1·2029	1·3412	1·4804	1·6205	1·7615	1·9034	2·0463
,,	6·41	,,	0	5	443	0·0000	0·0976	0·1959	0·2949	0·3946	0·4950	0·5960	0·6976	0·7999	0·9028	1·0063	1·1105	1·2153	1·3207	1·4268	1·5336
,,	6·41	,,	0	5	444	0·0000	0·0958	0·1922	0·2892	0·3867	0·4849	0·5836	0·6828	0·7826	0·8830	0·9840	1·0856	1·1877	1·2904	1·3937	1·4975
November 1	6·34	,,	0	5	445	0·0000	0·1009	0·2023	0·3043	0·4068	0·5098	0·6135	0·7177	0·8225	0·9279	1·0339	1·1405	1·2476	1·3554	1·4637	1·5726
,,	6·41	,,	0	5	446	0·0000	0·0951	0·1907	0·2868	0·3835	0·4808	0·5786	0·6770	0·7759	0·8755	0·9755	1·0762	1·1774	1·2792	1·3816	1·4844
,,	6·41	,,	0	5	447	0·0000	0·1022	0·2051	0·3086	0·4127	0·5174	0·6227	0·7287	0·8353	0·9425	1·0504	1·1590	1·2683	1·3781	1·4887	1·6000
,,	6·31	,,	0	3	448	0·0000	0·1242	0·2491	0·3746	0·5008	0·6277	0·7554	0·8837	1·0127	1·1425	1·2730	1·4042	1·5363	1·6691	1·8027	1·9371
December 4	70·0	6·27	3	0	449	0·0000	0·1225	0·2451	0·3679	0·4908	0·6138	0·7371	0·8606	0·9845	1·1088	1·2335	1·3587	1·4845	1·6109	1·7379	1·8654
,,	70·0	,,	3	0	450	0·0000	0·1236	0·2475	0·3717	0·4963	0·6212	0·7465	0·8721	0·9982	1·1248	1·2520	1·3797	1·5080	1·6369	1·7663	1·8962
,,	70·0	,,	3	0	451	0·0000	0·1230	0·2464	0·3702	0·4944	0·6190	0·7441	0·8694	0·9952	1·1213	1·2478	1·3746	1·5017	1·6291	1·7569	1·8848
,,	70·0	,,	2	8	452	0·0000	0·1356	0·2715	0·4077	0·5443	0·6813	0·8186	0·9563	1·0943	1·2328	1·3716	1·5108	1·6504	1·7903	1·9307	2·0715
December 5	70·0	,,	2	8	453	0·0000	0·1375	0·2753	0·4134	0·5519	0·6908	0·8300	0·9697	1·1097	1·2501	1·3910	1·5323	1·6740	1·8161	1·9586	2·1015
,,	70·0	,,	2	0	454	0·0000	0·1568	0·3141	0·4720	0·6305	0·7896	0·9493	1·1096	1·2704	1·4317	1·5935	1·7560	1·9189	2·0824	2·2464	2·4108
,,	70·0	,,	2	0	455	*0·0000*	*0·1686*	*0·3379*	*0·5078*	*0·6783*	*0·8495*	*1·0914*	*1·1940*	*1·3672*	*1·5419*	*1·7159*	*1·8914*	*2·0676*	*2·2447*		
,,	70·0	,,	2	0	456	0·0000	0·1566	0·3136	0·4709	0·6287	0·7869	0·9455	1·1045	1·2638	1·4235	1·5835	1·7439	1·9047	2·0659	2·2275	2·3895
,,	70·0	,,	2	0	457	0·0000	0·1692	0·3387	0·5087	0·6790	0·8498	1·0210	1·1926	1·3647	1·5371	1·7100	1·8834	2·0571	2·2313		
,,	70·0	,,	2	0	458	0·0000	0·1547	0·3101	0·4661	0·6227	0·7799	0·9377	1·0960	1·2549	1·4143	1·5742	1·7346	1·8954	2·0568	2·2186	
,,	70·0	,,	2	0	459	0·0000	0·1697	0·3398	0·5104	0·6814	0·8530	1·0250	1·1974	1·3703	1·5437	1·7176	1·8919	2·0667	2·2419		
,,	70·0	,,	1	12	460	*0·0000*	*0·1801*	*0·3609*	*0·5422*	*0·7249*	*0·9068*	*1·0900*	*1·2740*	*1·4586*	*1·6440*	*1·8301*	*2·0169*	*2·2045*	*2·3929*	*2·5822*	

REPORT VIII.—TABLE I.—*continued.*

Armstrong 6-inch B. L. Gun, and various forms of Heads of Shot.

Date of Experiment.	Weight of Shot = *w*.	Diameter of Shot = *d*.	Weight of Charge.	Number of Round.	Form of Head of Shot.	Screens 150 feet apart.											
						1	2	3	4	5	6	7	8	9	10	11	12
1879	lbs.	in.	lbs. oz.			″	″	″	″	″	″	″	″	″	″	″	″
March 5	70·0	6·0	33 0	461	Ogival	0·0000	0·0771	0·1552	0·2343	0·3142	0·3951	0·4768	0·5593	0·6427			
March 6	70·0	,,	33 0	462	,,	*0·0000*	*0·0775*	*0·1561*	*0·2357*	*0·3164*	*0·3982*	*0·4811*	*0·5651*	*0·6502*	*0·7363*	*0·8235*	*0·9117*
March 7	70·0	,,	33 0	463	,,	0·0000	0·0772	0·1554	0·2344	0·3145	0·3954	0·4773	0·5601	0·6439	0·7287	0·8144	0·9011
March 10	70·0	,,	33 0	464	Flat	0·0000	0·0787	0·1595	0·2423	0·3271	0·4139	0·5027	0·5935	0·6863	0·7812		
,, ...	70·0	,,	33 0	465	,,	0·0000	0·0791	0·1603	0·2435	0·3288	0·4162	0·5058	0·5975	0·6914	0·7876	0·8861	0·9868
,, ...	70·0	,,	33 0	466	,,	0·0000	0·0794	0·1606	0·2439	0·3293	0·4169	0·5067	0·5987	0·6927	0·7887	0·8867	0·9867
March 11	70·0	,,	33 0	467	Hemispherical	0·0000	0·0792	0·1597	0·2414	0·3244	0·4087	0·4942	0·5811	0·6692	0·7586	0·8493	0·9412
,, ...	70·0	,,	33 0	468	,,	0·0000	0·0794	0·1598	0·2412	0·3236	0·4073	0·4922	0·5786	0·6663	0·7556	0·8463	0·9386
,, ...	70·0	,,	33 0	469	,,	0·0000	0·0785	0·1583	0·2395	0·3220	0·4059	0·4911	0·5778	0·6658	0·7552	0·8460	0·9381
,, ...	70·0	,,	29 0	470	Ogival	0·0000	0·0844	0·1698	0·2564	0·3439	0·4325	0·5221	0·6126	0·7041	0·7965	0·8897	0·9836
,, ...	70·0	,,	29 0	471	,,	0·0000	0·0849	0·1706	0·2571	0·3445	0·4328						
,, ...	70·0	,,	29 0	472	,,	0·0000	0·0855	0·1721	0·2596	0·3481	0·4376	0·5282	0·6199	0·7126	0·8063	0·9011	
,, ...	50·0	,,	33 0	473	,,	0·0000	0·0699	0·1410	0·2135	0·2871	0·3620	0·4381	0·5154	0·5939	0·6734	0·7541	
,, ...	50·0	,,	33 0	474	,,	0·0000	0·0690	0·1393	0·2107	0·2832	0·3569	0·4318	0·5079	0·5852	0·6637	0·7434	
,, ...	50·0	,,	33 0	475	,,	0·0000	0·0692	0·1395	0·2110	0·2837	0·3577	0·4330	0·5094	0 5871	0·6659	0·7459	
,, ...	50·0	,,	33 0	476	,,	0·0000	0·0695	0·1401	0·2119	0·2848	0·3588	0·4340	0·5103	0·5878	0·6664	0·7461	
,, ...	50·0	,,	33 0	477	,,	0·0000	0·0688	0·1387	0·2098	0·2821	0·3555	0·4301	0·5059	0·5828	0·6609	0·7402	
March 12	50·0	,,	36 0	478	,,	0·0000	0·0668	0·1347	0·2036	0·2737	0·3448	0·4171	0·4904	0·5648			
,, ...	50·0	,,	36 0	479	,,	0·0000	0·0666	0·1343	0·2031	0·2729	0·3439	0·4159	0·4891	0·5633	0·6387	0·7151	0·7927
,, ...	50·0	,,	36 0	480	,,	0·0000	0·0660	0·1330	0·2011	0·2703	0·3406	0·4119	0·4844	0·5579	0·6325	0·7082	
,, ...	50·0	,,	36 0	481	,,	0·0000	0·0666	0·1343	0·2031	0·2729	0·3438	0·4158	0·4888	0·5628	0·6378	0·7138	0·7909
,, ...	50·0	,,	36 0	482	,,	0·0000	0·0657	0·1324	0·2004	0·2695	0·3397	0·4110	0·4834	0·5569	0·6314	0·7069	0·7835

Report VIII.—Table II.

Showing the Velocities of the Shot when passing each Screen.

(Shot with Ogival Heads.)

Date of Experiment.	Weight of Shot = w.	Diameter of Shot = d.	Weight of Charge.	Number of Round.	Screens 75 feet apart.														
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1878	lbs.	in.	lbs. oz.		f. s.	f. s.	f. s.	f. s.	f. s.	f. s.	f. s.	f. s.	f. s.	f. s.	f. s.	f. s.	f. s.	f. s.	f. s.	f. s.
September 13	6·50	2·97	0 12	412	1057	1043	1030	1018	1007	997	987	979	971	965	959	954	949	946	943	940
..	6·50	,,	0 12	413	1084	1072	1062	1052	1042	1033	1025	1018	1011	1004	997	991	984	978	972	966
,,	6·50	,,	0 12	414	1051	1040	1030	1021	1011	1003	995	988	982	976	970	963	957	951	945	
September 25	6·50	,,	0 10	415	964	956	948	941	934	928	921	915	908	901	894	887	880	873	867	
,,	6·56	,,	0 10	416	989	985	981	977	972	967	961	956	949	943	937	931	924	918	910	903
,,	6·50	,,	0 10	417	991	985	979	972	966	960	954	947	941	934	927	920	912	904	896	888
,,	6·44	,,	0 10	418	955	948	941	933	925	917	909	901	893	886	880	874				
,,	6·50	,,	0 10	419	969	964	958	953	947	942	937	931	925	919	912	905	898	892	886	
,,	6·50	,,	0 8	420	934	923	913	903	894	886	878	871								
,,	6·47	,,	0 8	421	904	903	901	899	896	892	887	882	876	870	863	856	848	839	830	
,,	6·56	,,	0 8	422	922	914	906	898	891	884	878	872	867	863	859	856	854	852	851	
,,	6 47	,,	0 8	423	888	884	881	878	875	871	867	863	859	855	850	845	840	835		
September 26	6·66	,,	0 6	424	779	774	769	764	759	754	749	745	741	737	733	729	725	721	717	714
,,	6·56	,,	0 6	425	798	794	790	786	782	777	772	767	762	757	752	746	741	735	730	724
,,	6·63	,,	0 6	426	733	729	725	721	717	713	709	704	700	695	690	685	679	673	668	662
,,	6·47	,,	0 6	427	818	813	809	805	800	796	792	788	783	779	775	770				
,,	6·63	,,	0 6	428	798	794	789	785	781	777	773	768	764	760	756	752	748	744	740	737
,,	6·47	,,	0 8	429	885	880	875	870	865	859	854	849	843	837	832	826	821	816	810	
,,	6·47	,,	0 8	430	856	851	847	842	838	834	829	825	821	817	813	809	805	801	797	793
September 27	6·50	,,	0 4	431	757	747	738	731	725	721										
,,	6·63	,,	0 4	432	717	714	711	708	704	701	697	693	690							
,,	6·56	,,	0 4	433	713	707	702	697	692	688	683	678	674	669	665	661	657	653	649	
,,	6·63	,,	0 4	434	737	732	727	722	716	712	707	702	698	693	689	685	681	677	673	
,,	6·56	,,	0 4	435	736	730	724	719	713	708	702	697	692	687	682	677	672	668	663	659

REPORT VIII.—TABLE II.—*continued.*

(Shot with Ogival Heads).

Date of Experiment.	Weight of Shot = *w*.	Diameter of Shot = *d*.	Weight of Charge.	Number of Round.	Screens 75 feet apart.														
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1878	lbs.	in.	lbs. oz.		f. s.	f. s.	f. s.	f. s.	f. s.	f. s.	f. s.	f. s.	f. s.	f. s.	f. s.	f. s.	f. s.	f. s.	f. s.	f. s.
September 27	6·63	2·97	0 4	436	700	696	691	686	681	676	672	667	663	658	654	650	646	643		
,,	6·63	,,	0 4	437	700	695	690	685	680	675	671	666	661	657	653	648	644	640	636	
,,	6·63	,,	0 3	438	608	602	596	591	586	581	577	573	569	566	563	560	558	555		
October 31	6·31	,,	0 3	439	584	581	577	573	570	566	563	560	557	553	550	547	543	540	537	534
,,	6·34	,,	0 3	440	603	599	595	592	588	585	581	577	574	570	567	563	560	556	553	549
,,	6·31	,,	0 3	441	594	591	587	583	579	576	573	569	566	563	560	557	554	551	549	546
,,	6·53	,,	0 3	442	580	576	571	567	563	559	556	552	548	544	541	537	534	531	527	524
,,	6·41	,,	0 5	443	771	766	761	755	750	745	740	736	731	727	722	718	714	709	705	701
,,	6·41	,,	0 5	444	785	781	776	772	767	762	758	753	749	745	741	737	732	729	725	721
November 1	6·34	,,	0 5	445	746	742	738	734	730	726	722	718	714	710	706	702	698	694	691	687
,,	6·41	,,	0 5	446	792	787	783	778	773	769	765	760	756	752	747	743	739	735	731	728
,,	6·41	,,	0 5	447	736	732	727	723	718	714	710	706	701	697	693	689	685	681	677	673
,,	6·31	,,	0 3	448	606	603	600	596	593	590	586	583	580	576	573	570	567	563	560	557
December 4	70·0	6·27	3 0	449	613	612	611	611	610	609	608	606	605	602	600	598	595	592	589	587
,,	70·0	,,	3 0	450	608	606	605	603	601	600	598	596	594	591	588	586	583	581	579	576
,,	70·0	,,	3 0	451	611	609	607	605	603	601	599	597	596	594	592	591	589	588	587	586
,,	70·0	,,	2 8	452	554	553	551	550	548	547	546	544	543	541	540	538	537	535	534	532
December 5	70·0	,,	2 8	453	546	545	544	542	541	539	538	536	535	533	532	530	529	527	526	524
,,	70·0	,,	2 0	454	479	478	476	474	472	471	469	467	466	464	463	461	460	458	457	455
,,	70·0	,,	2 0	455	*446*	*444*	*442*	*441*	*439*	*437*	*436*	*434*	*432*	*430*	*428*	*426*	*425*	*423*		
,,	70·0	,,	2 0	456	480	478	477	476	475	474	472	471	470	469	468	467	466	465	464	462
,,	70·0	,,	2 0	457	444	443	442	441	440	439	438	437	435	434	433	432	431	430		
,,	70·0	,,	2 0	458	486	484	482	480	478	476	475	473	471	470	468	467	466	464	463	
,,	70·0	,,	2 0	459	443	442	440	439	438	437	436	434	433	432	431	430	428	427		
,,	70·0	,,	1 12	460	*417*	*416*	*414*	*413*	*411*	*410*	*408*	*407*	*405*	*404*	*403*	*401*	*399*	*397*	*395*	

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REPORT VIII.—TABLE II.—*continued.*

Armstrong 6-inch B. L. Gun, and various forms of Heads of Shot.

Date of Experiment.	Weight of Shot = w.	Diameter of Shot = d.	Weight of Charge.	Number of Round.	Form of Head of Shot.	Screens 150 feet apart.											
						1	2	3	4	5	6	7	8	9	10	11	12
1879	lbs.	in.	lbs. oz.			f. s.	f. s.	f. s.	f. s.	f. s.	f. s.	f. s.	f. s.	f. s.	f. s.	f. s.	f. s.
March 5	70·0	6	33 0	461	Ogival	1959	1933	1909	1887	1866	1846	1826	1808	1790			
March 6	70·0	,,	33 0	462	,,	*1948*	*1922*	*1897*	*1879*	*1846*	*1821*	*1797*	*1774*	*1759*	*1731*	*1711*	*1691*
March 7	70·0	,,	33 0	463	,,	1953	1931	1909	1886	1864	1843	1822	1801	1780	1760	1740	1720
March 10	70·0	,,	33 0	464	Flat	1929	1881	1835	1790	1748	1709	1670	1634	1599	1564		
,, ...	70·0	,,	33 0	465	,,	1922	1872	1825	1780	1737	1695	1655	1616	1578	1541	1506	1472
,, ...	70·0	,,	33 0	466	,,	1913	1868	1823	1778	1734	1691	1651	1613	1578	1546	1516	1487
March 11	70·0	,,	33 0	467	Hemispherical	1910	1879	1850	1821	1793	1767	1740	1715	1690	1666	1643	1620
,, ...	70·0	,,	33 0	468	,,	1899	1878	1855	1832	1806	1779	1751	1723	1695	1667	1639	1612
,, ...	70·0	,,	33 0	469	,,	1929	1895	1863	1833	1803	1774	1745	1717	1691	1665	1641	1617
,, ...	70·0	,,	29 0	470	Ogival	1789	1767	1745	1723	1703	1684	1666	1648	1632	1617	1603	1589
,, ...	70·0	,,	29 0	471	,,	1775	1758	1742	1725	1708	1691						
,, ...	70·0	,,	29 0	472	,,	1764	1744	1724	1704	1685	1665	1646	1627	1609	1591	1574	
,, ...	50·0	,,	33 0	473	,,	2166	2128	2090	2053	2019	1987	1956	1927	1899	1872	1846	
,, ...	50·0	,,	33 0	474	,,	2192	2155	2118	2085	2051	2018	1986	1956	1926	1896	1867	
,, ...	50·0	,,	33 0	475	,,	2187	2151	2115	2080	2045	2011	1978	1946	1917	1889	1863	
,, ...	50·0	,,	33 0	476	,,	2176	2141	2107	2074	2043	2011	1980	1951	1922	1895	1867	
,, ...	50·0	,,	33 0	477	,,	2199	2163	2128	2093	2059	2027	1995	1964	1935	1907	1879	
March 12	50·0	,,	36 0	478	,,	2264	2228	2193	2158	2124	2092	2061	2031	2001			
,, ...	50·0	,,	36 0	479	,,	2271	2234	2199	2164	2131	2098	2066	2035	2006	1977	1948	1921
,, ...	50·0	,,	36 0	480	,,	2292	2256	2220	2185	2151	2118	2086	2055	2025	1996	1968	
,, ...	50·0	,,	36 0	481	,,	2270	2234	2199	2165	2132	2100	2070	2041	2012	1986	1960	1934
,, ...	50·0	,,	36 0	482	,,	2305	2265	2227	2190	2154	2120	2087	2057	2028	1999	1972	1944

Report VIII.—Table III.

Summary of the values of K_v derived from each round for Velocities between 430 f. s. and 1065 f. s.

Elongated Projectiles with Ogival Heads.

No. of Round.	K_v.
430 f. s.	
457	127·6
459	138·1
	2)265·7
	132·9
435 f. s.	
457	127·6
459	138·1
	2)265·7
	132·9
440 f. s.	
457	127·6
459	138·1
	2)265·7
	132·9
460 f. s.	
454	165·9
456	110·5
	2)276·4
	138·2
465 f. s.	
454	165·9
456	110·5
	2)276·4
	138·2
470 f. s.	
454	165 9
456	110·5
458	164·6
	3)441·0
	147·0
475 f.s.	
458	164·6
480 f. s.	
458	164·6
530 f.s.	
442	112·8
453	121·6
	2)234·4
	117·2
535 f. s.	
442	112·8
453	121·6
	2)234·4
	117·2
540 f. s.	
439	102·8
442	115·3
452	112·7
453	121·6
	4)452·4
	113·1
545 f. s.	
439	101·7
442	115·3
452	112·7
	3)329·7
	109·9
550 f. s.	
439	99·1
442	116·6
452	112·7
	3)328·4
	109·5
555 f. s.	
439	96·7
440	100·9
441	86·9
442	117·8
	4)402·3
	100·6
560 f. s.	
438	84·8
439	95·4
440	100·9
441	88·2
442	117·8
	5)487·1
	97·4

REPORT VIII.—TABLE III—*continued.*

Elongated Projectiles with Ogival Heads.

No. of Round.	K_v.
565 f. s.	
438	96·5
439	96·7
440	102·1
441	89·3
442	119·2
448	92·5
	6)596·3
	99·4
570 f. s.	
438	105·6
439	97·9
440	102·1
441	91·8
442	121·7
448	92·5
	6)611·6
	101·9
575 f. s.	
438	116·0
439	99·1
440	102·1
441	94·2
448	91·2
	5)502·6
	100·5
580 f. s.	
440	100·9
441	97·9
448	88·8
	3)287·6
	95·9
585 f. s.	
440	98·4
441	100·4
448	90·0
	3)288·8
	96·3
590 f. s.	
440	94·7
448	88·8
450	141·8
451	110·6
	4)435·9
	109·0
595 f. s.	
440	92·2
448	87·5
450	141·8
451	110·6
	4)432·1
	108·0
600 f. s.	
448	86·2
449	107·6
450	141·8
451	110·6
	4)446·2
	111·6
605 f. s.	
449	107·6
610 f. s.	
449	107·6
645 f. s.	
437	95·2
650 f. s.	
436	91·2
437	97·8
	2)189·0
	94·5
655 f. s.	
433	90·3
436	95·2
437	100·4
	3)285·9
	95·3
660 f. s.	
433	91·6
436	97·8
437	101·7
	3)291·1
	97·0
665 f. s.	
433	92·9
435	99·3
436	100·4
437	103·1
	4)395·7
	98·9

REPORT VIII.—TABLE III—*continued.*

Elongated Projectiles with Ogival Heads.

No. of Round,	K_v.
670 f. s.	
433	92·9
435	100·6
436	104·3
437	103·1
	4)400·9
	100·2
675 f. s.	
433	95·4
435	100·6
436	103·1
437	104·3
	4)403·4
	100·9
680 f. s.	
426	119·2
433	96·8
434	86·1
435	101·9
436	99·2
437	103·1
447	82·7
	7)689·0
	98·4
685 f. s.	
426	112·7
433	96·8
434	87·3
435	103·3
436	97·8
437	104·3
447	80·2
	7)682·4
	97·5

No. of Round.	K_v.
690 f. s.	
426	107·5
433	98·1
434	87·3
435	103·3
436	95·2
437	104·3
447	82·7
	7)678·4
	96·9
695 f. s.	
426	99·6
432	75·6
433	98·1
434	88·7
435	103·3
445	71·8
447	81·4
	7)618·5
	88·4
700 f. s.	
426	94·3
432	73·0
433	99·3
434	90·0
435	104·4
445	71·8
447	81·4
	7)614·2
	87·7
705 f. s.	
426	86·5
432	67·8
434	92·6
435	104·4
445	73·1
447	81·4
	6)505·8
	84·3

No. of Round.	K_v.
710 f. s.	
426	81·2
432	62·6
434	92·6
435	104·4
443	80·9
445	70·6
447	80·2
	7)572·5
	81·8
715 f. s.	
426	79·9
434	95·2
435	105·8
443	79·6
445	73·1
447	78·9
	6)512·5
	85·4
720 f. s.	
424	73·7
426	78·6
434	97·8
435	105·8
443	78·4
445	71·8
447	78·9
	7)585·0
	83·6
725 f. s.	
424	72·4
434	99·2
435	105·8
443	77·1
445	71·8
447	78·9
	6)505·2
	84·2

REPORT VIII.—TABLE III—*continued.*

Elongated Projectiles with Ogival Heads.

No. of Round.	K_v.
730 f. s.	
424	72·4
443	78·4
444	70·8
445	69·4
	4)291·0
	72·8
735 f. s.	
424	73·7
425	102·4
443	78·4
444	70·8
445	68·2
446	70·1
	6)463·6
	77·3
740 f. s.	
424	75·0
425	99·8
443	78·4
444	70·8
446	70·1
	5)394·1
	78·8
745 f. s.	
424	76·4
425	97·3
428	70·8
443	83·4
444	70·8
446	70·1
	6)468·8
	78·1

No. of Round.	K_v.
750 f. s.	
55	90·3
57	90·2
138	95·2
424	80·3
425	93·4
428	70·8
443	85·8
444	70·8
446	71·4
	9)748·2
	83·1
755 f. s.	
55	90·3
56	87·9
57	86·6
138	95·2
424	83·0
425	90·7
428	69·4
443	85·8
444	72·1
446	70·1
	10)831·1
	83·1
760 f. s.	
55	90·3
56	85·5
57	85·5
60	95·2
138	95·2
424	84·2
425	86·9
428	69·4
443	87·0
444	72·1
446	71·4
	11)922·7
	83·9

No. of Round.	K_v.
765 f. s.	
55	90·3
56	85·5
57	82·9
59	102·5
60	92·8
137	96·5
138	95·2
424	84·2
425	84·2
428	69·4
444	72·1
446	70·1
	12)1025·7
	85·5
770 f. s.	
55	90·3
56	83·0
57	80·6
59	102·5
60	91·5
135	94·1
137	96·5
138	95·2
425	81·7
428	69·4
444	72·1
446	71·4
	12)1028·3
	85·7
775 f. s.	
57	80·6
59	100·1
60	87·9
135	92·9
137	94·1
425	76·5
428	69·4
444	72·1
446	70·1
	9)743·7
	82·6

REPORT VIII.—TABLE III—*continued.*

Elongated Projectiles with Ogival Heads.

No. of Round.	K_v.
	780 f. s.
57	80·6
59	100·1
60	87·9
135	91·7
137	91·7
425	70·0
427	70·3
428	66·8
446	70·1
	9)729·2
	81·0
	785 f. s.
59	95·2
137	89·3
425	67·4
427	66·5
428	65·5
	5)383·9
	76·8
	790 f. s.
137	86·8
427	63·9
428	65·5
	3)216·2
	72·1
	795 f. s.
137	86·8
427	62·7
	2)149·5
	74·8
	800 f. s.
427	62·7
430	60·1
	2)122·8
	61·4
	805 f. s.
427	63·9
430	58·8
	2)122·7
	61·4
	810 f. s.
427	63·9
430	57·5
	2)121·4
	60·7
	815 f. s.
430	57·5
	820 f. s.
429	75·4
430	57·5
	2)132·9
	66·5
	825 f. s.
122	89·7
429	75·4
430	58·8
	3)223·9
	74·6
	830 f. s.
122	89·7
429	76·7
430	60·1
	3)226·5
	75·5
	835 f. s.
122	89·7
429	76·7
430	60·1
	3)226·5
	75·5
	840 f. s.
122	89·7
429	75·4
430	60·1
	3)225·2
	75·1
	845 f. s.
28	61·6
121	91·9
122	89·7
429	75·4
430	60·1
	5)378·7
	75·7

REPORT VIII.—TABLE III—*continued.*

Elongated Projectiles with Ogival Heads.

No. of Round.	K_v.
850 f. s.	
28	61·6
31	61·2
32	61·2
121	91·9
122	88·6
178	61·3
423	66·0
429	74·1
	8)565·9
	70·7
855 f. s.	
27	46·4
28	61·6
29	65·0
30	66·9
31	61·2
32	61·2
121	91·9
122	90·8
177	59·5
421	111·2
423	60·8
429	71·6
	12)848·1
	70·7
860 f. s.	
28	61·6
29	65·0
30	64·0
31	61·2
32	61·2
121	93·0
122	89·7
177	57·8
421	97·0
422	47·1
423	56·9
429	69·0
	12)823·5
	68·6
865 f. s.	
26	62·2
28	61·6
29	63·1
30	63·1
31	61·2
32	59·3
121	93·0
122	89·7
177	57·8
421	91·9
422	57·7
423	51·8
429	66·5
	13)878·9
	67·6
870 f. s.	
26	62·2
28	61·6
29	63·1
30	61·8
32	55·7
121	94·1
177	57·8
421	84·1
422	65·6
423	46·5
429	65·2
	11)717·7
	65·2
875 f. s.	
26	62·2
28	61·6
177	57·8
421	77·6
422	73·4
423	42·7
429	63·9
	7)439·2
	62·7
880 f. s.	
26	62·2
28	61·6
177	57·8
415	85·8
421	71·1
422	81·3
423	40·1
	7)459·9
	65·7
885 f. s.	
26	62·2
415	85·8
418	81·1
421	63·5
422	85·2
	5)377·8
	75·6
890 f. s.	
178	64·8
415	85·8
418	83·7
421	55·7
422	86·6
	5)376·6
	75·3
895 f. s.	
178	63·0
415	84·5
418	85·0
421	40·1
422	89·2
	5)361·8
	72·4

REPORT VIII.—TABLE III—*continued.*

Elongated Projectiles with Ogival Heads.

No. of Round.	K_v.
900 f. s.	
178	61·3
415	83·1
418	92·6
419	79·3
422	91·8
5)408·1	
81·6	
905 f. s.	
178	61·3
415	83·1
418	93·9
419	80·5
4)318·8	
79·7	
910 f. s.	
178	61·3
415	81·8
418	95·2
419	80·5
4)318·8	
79·7	
915 f. s.	
178	61·3
415	79·3
417	88·4
418	95·2
419	78·0
5)402·2	
80·4	

No. of Round.	K_v.
920 f. s.	
24	73·0
178	61·3
415	76·7
416	80·0
417	84·5
418	93·9
419	74·1
7)543·5	
77·6	
925 f. s.	
24	73·0
178	61·3
415	75·3
416	77·4
417	81·8
418	92·6
419	68·9
7)530·3	
75·8	
930 f. s.	
24	73·0
415	74·1
416	74·8
417	79·3
418	90·2
419	66·3
6)457·7	
76·3	
935 f. s.	
20	58·2
24	72·4
25	69·9
415	74·1
416	72·1
417	75·4
418	85·0
419	62·4
8)569·5	
71·2	

No. of Round.	K_v.
940 f. s.	
20	56·9
24	71·8
25	68·0
227	101·5
415	76·7
416	69·5
417	72·8
418	82·4
419	59·8
9)659·4	
73·3	
945 f. s.	
20	56·9
24	71·8
25	67·4
51	84·2
225	107·2
227	96·0
416	66·9
417	71·5
419	58·4
9)680·3	
75·6	
950 f. s.	
20	56·9
24	71·8
25	67·4
51	83·6
223	96·3
224	107·5
225	107·2
227	84·7
412	44·0
416	65·6
417	70·1
419	58·4.
12)913·5	
76·1	

REPORT VIII.—TABLE III—*continued.*

Elongated Projectiles with Ogival Heads.

No. of Round.	K_v.
955 f. s.	
20	56·9
21	59·3
24	71·1
25	67·4
51	83·0
223	93·5
224	104·7
225	107·2
227	84·7
412	50·5
416	64·3
417	68·8
419	58·4
	13)969·8
	74·6
960 f. s.	
20	55·7
21	59·3
24	71·1
25	66·8
51	82·3
222	65·1
223	90·7
224	101·9
225	107·2
227	81·9
412	57·0
414	64·8
416	68·0
417	66·3
	14)1033·1
	73·8

No. of Round.	K_v.
965 f. s.	
20	55·7
21	58·1
24	71·1
25	66·8
51	81·8
53	92·8
222	65·1
223	90·7
224	99·2
225	107·2
226	93·1
412	63·5
414	64·8
416	59·0
417	63·7
	15)1132·6
	75·5
970 f. s.	
20	54·4
21	56·8
24	71·1
25	66·8
50	92·8
51	81·2
53	90·3
103	66·7
222	65·1
223	90·7
224	96·3
226	90·3
412	69·9
414	64·8
416	55·0
417	65·0
	16)1177·2
	73·6

No. of Round.	K_v.
975 f. s.	
20	54·4
21	58·1
24	71·1
25	66·8
50	90·3
51	80·6
53	90·3
103	66·7
105	77·8
162	91·1
222	65·1
223	90·7
224	90·7
226	84·7
412	76·4
414	64·8
416	49·8
	17)1269·4
	74·7
980 f. s.	
20	54·4
21	56·9
23	77·9
24	71·1
25	66·8
50	87·9
51	80·6
53	90·3
103	71·2
104	66·7
105	77·8
162	91·1
412	81·6
413	63·5
414	64·8
	15)1102·6
	73·5

Report VIII.—Table III—*continued.*

Elongated Projectiles with Ogival Heads.

No. of Round.	K_v
985 f. s.	
20	54·4
21	56·9
23	77·9
24	71·1
25	66·3
49	67·9
50	87·9
51	80·6
53	90·3
103	71·2
104	64·9
105	77·8
162	91·1
161	71·4
412	85·5
413	63·5
414	66·1
	17)1244·8
	73·2
990 f. s.	
20	54·4
21	56·9
23	79·2
24	71·1
25	65·6
49	67·9
50	86·7
51	80·6
52	70·8
53	87·9
54	80·6
103	78·3
105	82·3
160	75·3
161	71·4
162	91·1
412	89·4
413	64·8
414	68·6
	19)1417·9
	74·6
995 f. s.	
20	54·4
21	56·9
23	79·2
24	71·1
25	65·6
49	67·9
50	83·0
51	79·9
52	73·3
53	87·9
54	81·5
103	80·0
105	84·5
160	75·3
161	71·4
162	91·1
412	93·3
413	64·8
414	71·3
	19)1432·4
	75·4
1000 f. s.	
20	53·2
21	58·1
23	77·9
24	71·1
25	66·8
49	67·9
50	80·6
51	79·3
52	73·3
53	87·9
54	81·5
105	84·5
160	75·3
161	71·4
162	91·1
163	62·0
412	97·2
413	64·8
414	73·9
	19)1417·8
	74·6
1005 f. s.	
20	51·9
21	56·9
23	77·9
24	71·1
25	66·2
49	67·9
50	73·3
51	78·7
52	73·3
53	85·5
54	75·7
159	70·0
160	75·3
161	71·4
162	91·1
163	62·0
412	99·7
413	64·8
414	77·7
	19)1390·4
	73·2
1010 f. s.	
23	77·9
24	71·1
25	65·6
49	67·9
50	78·2
51	78·7
52	75·7
53	82·9
54	75·7
159	73·5
160	75·3
161	71·4
162	91·1
163	62·0
413	66·1
414	80·3
	16)1193·4
	74·6

REPORT VIII.—TABLE III—*continued.*

Elongated Projectiles with Ogival Heads.

No. of Round.	K_v.
1015 f. s.	
23	76·7
24	71·8
25	64·5
49	67·9
50	73·3
51	78·3
52	78·2
53	82·9
54	75·7
159	73·5
160	75·3
161	71·4
163	62·0
175	84·0
413	67·3
414	82·9
	16)1185·7
	74·1
1020 f. s.	
23	76·7
49	67·9
50	68·4
51	78·2
52	78·2
54	73·3
159	73·5
160	75·3
161	71·4
163	62·0
175	84·0
413	69·9
414	85·5
	13)964·3
	74·2
1025 f. s.	
23	76·7
49	67·9
51	78·2
52	80·6
54	73·3
159	73·5
160	75·3
163	62·0
175	85·8
413	72·6
	10)745·9
	74·6

No. of Round.	K_v.
1030 f. s.	
23	76·7
49	67·9
51	77·5
52	80·6
159	75·3
163	62·0
175	85·8
413	75·2
	8)601·0
	75·1
1035 f. s.	
16	96·5
23	76·7
49	67·9
51	76·9
52	80·6
159	73·5
175	85·8
413	77·7
	8)635·6
	79·5
1040 f. s.	
16	98·4
23	76·7
159	77·0
175	87·6
413	80·3
	5)420·0
	84·0
1045 f. s.	
14	93·6
16	98·4
175	88·5
176	85·3
413	82·9
	5)448·7
	89·7

No. of Round.	K_v.
1050 f. s.	
14	98·6
16	98·4
175	89·3
176	85·3
413	85·5
	5)452·1
	90·4
1055 f. s.	
14	93·6
16	98·4
175	89·3
176	85·3
	4)366·6
	91·7
1060 f. s.	
14	95·5
16	96·5
175	91·2
176	85·3
	4)368·5
	92·1
1065 f. s.	
14	95·5
16	96·5
175	94·2
176	85·3
	4)371·5
	92·9

Report VIII.—Table IV.

Corrected Mean Values of K_v from Table III., for intervals of 5 f. s. in velocity.

Elongated Projectiles with Ogival Heads.

Velocity.	Mean Values of K_v, found by Experiment.	Corrections.	Corrected Values of K_v.	Differences.	Velocity.	Mean Values of K_v, found by Experiment.	Corrections.	Corrected Values of K_v.	Differences.
f. s.					f. s.				
430	132·9	+ 6·9	139·8		550	109·5	+ 1·2	110·7	
				−1·3					−1·0
435	132·9	+ 5·6	138·5		555	100·6	+ 9·1	109·7	
				1·3					1·0
440	132·9	+ 4·3	137·2		560	97·4	+11·3	108·7	
				1·3					1·0
445			135·9		565	99·4	+ 8·3	107·7	
				1·3					1·0
450			134·6		570	101·9	+ 4·8	106·7	
				1·3					1·0
455			133·3		575	100·5	+ 5·2	105·7	
				1·3					1·1
460	138·2	− 6·2	132·0		580	95·9	+ 8·7	104·6	
				1·3					1·0
465	138·2	− 7·5	130·7		585	96·3	+ 7·3	103·6	
				1·3					1·1
470	147·0	−17·6	129·4		590	109·0	− 6·5	102·5	
				1·2					1·0
475	164·6	−36·4	128·2		595	108·0	− 6·5	101·5	
				1·3					1·0
480	164·6	−37·7	126·9		600	111·6	−11·1	100·5	
				1·2					1·0
485			125·7		605	107·6	− 8·1	99·5	
				1·3					·9
490			124·4		610	107·6	− 9·0	98·6	
				1·2					·9
495			123·2		615			97·7	
				1·3					·9
500			121·9		620			96·8	
				1·2					·9
505			120·7		625			95·9	
				1·1					·8
510			119·6		630			95·1	
				1·2					·8
515			118·4		635			94·3	
				1·1					·8
520			117·3		640			93·5	
				1·2					·8
525			116·1		645	95·2	− 2·5	92·7	
				1·1					·8
530	117·2	− 2·2	115·0		650	94·5	− 2·6	91·9	
				1·1					·7
535	117·2	− 3·3	113·9		655	95·3	− 4·1	91·2	
				1·1					·7
540	113·1	− 0·3	112·8		660	97·0	− 6·5	90·5	
				1·0					·7
545	109·9	+ 1·9	111·8		665	89·9	− 0·1	89·8	
				1·1					·7

REPORT VIII.—TABLE IV—*continued.*

Elongated Projectiles with Ogival Heads.

Velocity.	Mean Values of K_v, found by Experiment.	Corrections.	Corrected Values of K_v.	Differences.	Velocity.	Mean Values of K_v, found by Experiment.	Corrections.	Corrected Values of K_v.	Differences.
f. s.					f. s.				
670	100·2	−11·1	89·1		800	61·4	+14·8	76·2	
				− ·7					− ·3
675	100·9	−12·5	88·4		805	61·4	+14·5	75·9	
				·7					·3
680	98·4	−10·7	87·7		810	60·7	+14·9	75·6	
				·7					·2
685	97·5	−10·5	87·0		815	57·5	+17·9	75·4	
				·7					·2
690	96·9	−10·6	86·3		820	66·5	+ 8·7	75·2	
				·7					·1
695	88·4	− 2·8	85·6		825	74·6	+ 0·5	75·1	
				·7					0
700	87·7	− 2·8	84·9		830	75·5	− 0·4	75·1	
				·6					·1
705	84·3		84·3		835	75·5	− 0·5	75·0	
				·6					0
710	81·8	+ 1·9	83·7		840	75·1	− 0·1	75·0	
				·6					0
715	85·4	− 2·3	83·1		845	75·7	− 0·7	75·0	
				·5					0
720	83·6	− 1·0	82·6		850	70·7	+ 4·3	75·0	
				·5					0
725	84·2	− 2·1	82·1		855	70·7	+ 4·3	75·0	
				·5					0
730	72·8	+ 8·8	81·6		860	68·6	+ 6·4	75·0	
				·5					0
735	77·3	+ 3·8	81·1		865	67·6	+ 7·4	75·0	
				·5					0
740	78·8	+ 1·8	80·6		870	65·2	+ 9·8	75·0	
				·5					0
745	78·1	+ 2·0	80·1		875	62·7	+12·3	75·0	
				·5					0
750	83·1	− 3·5	79·6		880	65·7	+ 9·3	75·0	
				·5					0
755	83·1	− 4·0	79·1		885	75·6	− 0·6	75·0	
				·4					0
760	83·9	− 5·2	78·7		890	75·3	− 0·3	75·0	
				·4					0
765	85·5	− 7·2	78·3		895	72·4	+ 2·6	75·0	
				·3					0
770	85·7	− 7·7	78·0		900	81·6	− 6·6	75·0	
				·3					0
775	82·6	− 4·9	77·7		905	79·7	− 4·7	75·0	
				·3					0
780	81·0	− 3·6	77·4		910	79·7	− 4·7	75·0	
				·3					0
785	76·8	+ 0·3	77·1		915	80·4	− 5·4	75·0	
				·3					0
790	72·1	+ 4·7	76·8		920	77·6	− 2·6	75·0	
				·3					0
795	74·8	+ 1·7	76·5		925	75·8	− 0·8	75·0	
				·3					0

REPORT VIII.—TABLE IV—*continued.*

Elongated Projectiles with Ogival Heads.

Velocity.	Mean Values of K_v, found by Experiment.	Corrections.	Corrected Values of K_v.	Differences.	Velocity.	Mean Values of K_v, found by Experiment.	Corrections.	Corrected Values of K_v.	Differences.
f. s.					f. s.				
930	76·3	− 1·3	75·0		1045	89·7	− 5.9	83·8	
				0					+3·5
935	71·2	+ 3·8	75·0		1050	90·4	− 3·1	87·3	
				0					3·5
940	73·3	+ 1·7	75·0		1055	91·7	− 0·9	90·8	
				0					3·2
945	75·6	− 0·6	75·0		1060	92·1	+ 1·9	94·0	
				0					2·6
950	76·1	− 1·1	75·0		1065	92·9	+ 3·7	96·6	
				0					2·1
955	74·6	+ 0·4	75·0		1070			98·7	
				0					1·9
960	73·8	+ 1·2	75·0		1075			100·6	
				0					1·6
965	75·5	− 0·5	75·0		1080			102·2	
				0					1·5
970	73·6	+ 1·4	75·0		1085			103·7	
				0					1·2
975	74·7	+ 0·3	75·0		1090			104·9	
				0					1·0
980	73·5	+ 1·5	75·0		1095			105·9	
				0					1·0
985	73·2	+ 1·8	75·0		1100			106·9	
				0					·9
990	74·6	+ 0·4	75·0		1105			107·8	
				0					·6
995	75·4	− 0·4	75·0		1110			108·4	
				0					·4
1000	74·6	+ 0·4	75·0		1115			108·8	
				0					·4
1005	73·2	+ 1·8	75·0		1120			109·2	
				+ ·1					·3
1010	74·6	+ 0·5	75·1		1125			109·5	
				·1					·1
1015	74·1	+ 1·1	75·2		1130			109·6	
				·1					0
1020	74·2	+ 1·1	75·3		1135			109·6	
				·4					0
1025	74·6	+ 1·1	75·7		1140			109·6	
				1·0					0
1030	75·1	+ 1·6	76·7		1145			109·6	
				1·7					0
1035	79·5	− 1·1	78·4		1150			109·6	
				2·4					
1040	84·0	− 3·2	80·8						
				3·0					

Report VIII.—Table V.

Summary of the Values of K_v derived from each round, for Velocities between 1600 f. s. and 2250 f. s.

Elongated Projectiles with Ogival Heads.

No. of Round.	K_v.
1600 f. s.	
113	93·2
114	97·2
115	100·6
117	92·6
145	90·8
146	88·6
147	90·3
154	95·2
155	83·3
156	85·5
157	78·4
158	93·4
472	86·4
13)	1175·5
	90·4
1610 f. s.	
113	92·6
115	100·0
117	92·0
145	90·8
146	88·1
147	90·3
154	94·8
155	82·0
156	84·6
157	76·7
158	93·2
472	85·6
12)	1070·7
	89·2
1620 f. s.	
115	99·4
117	90·9
145	90·3
146	88·1
147	89·9
154	94·8
155	81·1
156	83·3
158	93·0
470	69·0
472	87·1
11)	966·9
	87·9
1630 f. s.	
145	90·3
146	88·1
147	89·9
470	76·5
472	88·5
5)	433·3
	86·7
1640 f. s.	
144	73·6
145	89·9
146	88·1
147	89·9
470	75·6
472	87·5
6)	504·6
	84·1
1650 f. s.	
144	73·6
145	89·9
146	87·7
147	89·9
470	77·7
472	86·5
6)	505·3
	84·2
1660 f. s.	
144	73·6
145	89·9
146	87·7
147	89·9
470	79·9
472	86·5
6)	507·5
	84·6
1670 f. s.	
144	73·6
145	89·5
146	87·7
147	89·9
470	81·5
472	86·9
6)	509·1
	84·9
1680 f. s.	
144	73·6
145	89·5
146	87·3
147	89·9
470	83·1
472	87·3
6)	510·7
	85·1
1690 f. s.	
144	73·6
145	89·5
146	87·3
147	89·5
470	83·6
472	85·2
6)	508·7
	84·8
1700 f. s.	
144	73·6
145	89·5
146	87·3
147	89·5
470	84·0
472	83·1
6)	507·0
	84·5

REPORT VIII.—TABLE V—*continued.*

Elongated Projectiles with Ogival Heads.

No. of Round.	K_v.
1710 f. s.	
145	89·0
146	87·3
147	89·5
470	84·8
471	75·0
472	83·1
	6)508·7
	84·8
1720 f. s.	
145	89·0
146	86·8
470	85·6
471	69·4
472	83·1
	5)413·9
	82·8
1730 f. s.	
146	86·8
470	89·0
471	68·4
472	81·9
	4)326·1
	81·5
1740 f. s.	
470	92·3
471	67·4
472	80·7
	3)240·4
	80·1
1750 f. s.	
470	89·6
471	67·0
	2)156·6
	78·3
1760 f. s.	
463	81·3
470	87·0
471	66·5
	3)234·8
	78·3
1770 f. s.	
463	80·5
1780 f. s.	
463	79·7
1790 f. s.	
463	79·2
1800 f. s.	
463	78·8
1810 f. s.	
461	70·5
463	78·8
	2)149·3
	74·7
1820 f. s.	
461	71·0
463	78·8
	2)149·8
	74·9
1830 f. s.	
461	71·4
463	78·0
	2)149·4
	74·7
1840 f. s.	
461	72·2
463	77·2
	2)149·4
	74·7
1850 f. s.	
461	73·0
463	76·3
	2)149·3
	74·7
1860 f. s.	
461	73·4
463	75·5
	2)148·9
	74·5
1870 f. s.	
461	73·8
463	77·1
473	65·9
	3)216·8
	72·3

REPORT VIII.—TABLE V—*continued.*

Elongated Projectiles with Ogival Heads.

No. of Round.	K_v.
1880 f. s.	
461	75·0
463	78·7
473	66·3
	3)220·0
	73·3
1890 f. s.	
461	76·3
463	80·4
473	66·8
	3)223·5
	74·5
1900 f. s.	
461	77·6
463	79·6
473	67·2
474	72·5
475	67·2
476	68·3
477	68·3
	7)500·7
	71·5
1910 f. s.	
461	78·9
463	78·8
473	67·6
474	72·0
475	68·0
476	67·8
477	68·3
	7)501·4
	71·6
1920 f. s.	
463	75·9
473	68·0
474	71·6
475	68·9
476	67·2
477	68·0
	6)419·6
	69·9
1930 f. s.	
463	73·0
473	68·3
474	71·1
475	69·7
476	67·2
477	67·8
	6)417·1
	69·5
1940 f. s.	
473	69·1
474	70·7
475	70·6
476	67·2
477	67·6
	5)345·2
	69·0
1950 f. s.	
473	69·9
474	70·7
475	71·4
476	67·2
477	67·5
479	66·9
	6)413·6
	68·9
1960 f. s.	
473	70·7
474	70·7
475	71·8
476	68·0
477	67·3
479	66·9
	6)415·4
	69·2
1970 f. s.	
473	70·7
474	70·7
475	72·3
476	68·7
477	67·2
479	66·9
482	65·1
	7)481·6
	68·8
1980 f. s.	
473	70·7
474	70·7
475	72·7
476	69·5
477	68·6
479	66·9
481	62·0
482	64·3
	8)545·4
	68·2

REPORT VIII.—TABLE V—*continued.*

Elongated Projectiles with Ogival Heads.

No. of Round.	K_v.
1990 f. s.	
473	70·7
474	70·7
475	73·6
476	69·1
477	70·0
479	66·9
480	65·2
481	62·0
482	63·5
	9)611·7
	68·0
2000 f. s.	
473	71·5
474	70·7
475	74·5
476	68·7
477	71·3
479	66·9
480	65·6
481	62·0
482	62·7
	9)613·9
	68·2
2010 f. s.	
473	72·2
474	70·7
475	75·4
476	68·3
477	70·9
479	66·6
480	66·0
481	62·0
482	63·3
	9)615·4
	68·4
2020 f. s.	
473	73·0
474	70·7
475	75·2
476	68·3
477	70·4
479	66·3
480	66·3
481	61·9
482	63·9
	9)616·0
	68·4
2030 f. s.	
473	73·2
474	70·7
475	75·0
476	68·3
477	69·9
478	66·3
479	66·0
480	66·5
481	61·6
482	64·5
	10)682·0
	68·2
2040 f. s.	
473	73·4
474	70·7
475	74·7
476	68·3
477	69·4
478	65·5
479	65·8
480	66·7
481	61·4
482	64·1
	10)680·0
	68·0
2050 f. s.	
473	73·6
474	70·7
475	74·5
476	67·5
477	68·8
478	64·7
479	66·0
480	66·9
481	61·8
482	63·7
	10)678·2
	67·8
2060 f. s.	
473	74·5
474	70·7
475	73·6
476	66·8
477	68·3
478	63·9
479	66·1
480	66·3
481	62·3
482	63·3
	10)675·8
	67·6
2070 f. s.	
473	75·4
474	70·7
475	72·8
476	66·0
477	69·3
478	64·7
479	66·3
480	65·7
481	62·7
482	64·1
	10)677·7
	67·8

REPORT VIII.—TABLE V.—*continued.*

Elongated Projectiles with Ogival Heads.

No. of Round.	K_v.	No. of Round.	K_v.	No. of Round.	K_v.
2080 f. s.		2110 f. s.		2140 f. s.	
473	76·3	473	76·3	474	70·7
474	70·7	474	70·7	475	70·1
475	71·9	475	69·7	476	67·2
476	66·3	476	67·2	477	68·7
477	70·3	477	70·1	478	67·2
478	65·5	478	66·7	479	65·5
479	67·8	479	67·6	480	65·8
480	65·1	480	65·6	481	65·4
481	63·6	481	65·3	482	68·4
482	65·0	482	67·0		9)609·0
	10)682·5		10)686·2		67·7
	68·3		68·6		
2090 f. s.		2120 f. s.			
473	77·2	473	75·8	2150 f. s.	
474	70·7	474	70·7		
475	71·2	475	69·0		
476	66·6	476	67·2	474	70·7
477	71·3	477	69·5	475	70·7
478	66·3	478	66·9	477	68·5
479	68·3	479	66·3	478	67·3
480	65·3	480	65·8	479	65·9
481	64·3	481	65·6	480	65·8
482	65·8	482	67·5	481	65·0
	10)687·0		10)684·3	482	68·8
	68·7		68·4		8)542·7
					67·8
2100 f. s.		2130 f. s.			
473	76·7	473	75·4		
474	70·7	474	70·7	2160 f. s.	
475	70·5	475	69·6		
476	66·9	476	67·2		
477	70·7	477	68·9	477	68·3
478	66·5	478	67·0	478	67·5
479	68·8	479	65·1	479	66·3
480	65·4	480	65·8	480	66·0
481	65·1	481	65·8	481	64·5
482	66·4	482	67·9	482	69·4
	10)687·7		10)683·4		6)402·0
	68·8		68·3		67·0

REPORT VIII.—TABLE V—*continued.*

Elongated Projectiles with Ogival Heads.

No. of Round.	K_v	No. of Round.	K_v	No. of Round.	K_v
2170 f. s.		2200 f. s.		2230 f. s.	
478	66·7	478	65·6	479	66·3
479	66·5	479	66·9	480	65·5
480	66·1	480	66·3	481	66·3
481	64·5	481	64·5	482	68·8
482	70·0	482	70·6		
	5)333·8		5)333·9		4)266·9
	66·8		66·8		66·7
2180 f. s.		2210 f. s.			
478	65·8	478	65·9	2240 f. s.	
479	66·6	479	66·7		
480	66·3	480	66·3		
481	64·5	481	65·1	480	64·7
482	70·6	482	70·0	482	69·0
	5)333·8		5)334·0		2)133·7
	66·8		66·8		66·9
2190 f. s.		2220 f. s.			
478	65·0	478	66·3	2250 f. s.	
479	66·8	479	66·5		
480	66·3	480	66·3		
481	64·5	481	65·7	480	63·9
482	71·2	482	69·4	482	69·2
	5)333·8		5)334·2		2)133·1
	66·8		66·8		66·6

Report VIII.—Table VI.

Corrected Mean Values of K_v from Table V, for intervals of 10 f.s. in Velocity.

Elongated Shot with Ogival Heads.

Velocity.	Mean Values of K_v, found by Experiment.	Correction.	Corrected Values of K_v.	Differences.	Velocity.	Mean Values of K_v, found by Experiment.	Correction.	Corrected Values of K_v.	Differences.
f. s.					f. s.				
1500	—	—	97·9		1710	84·8	−2·4	82·4	
				−·8					−·6
1510	—	—	97·1		1720	82·8	−1·0	81·8	
				−·9					−·6
1520	—	—	96·2		1730	81·5	− ·3	81·2	
				−·9					−·6
1530	—	—	95·3		1740	80·1	+ ·5	80·6	
				−·9					−·6
1540	—	—	94·4		1750	78·3	+1·7	80·0	
				−·8					−·5
1550	—	—	93·6		1760	78·3	+1·2	79·5	
				−·8					−·6
1560	—	—	92·8		1770	80·5	−1·6	78·9	
				−·8					−·5
1570	—	—	92·0		1780	79·7	−1·3	78·4	
				−·8					−·6
1580	—	—	91·2		1790	79·2	−1·4	77·8	
				−·8					−·5
1590	—	—	90·4		1800	78·8	−1·5	77·3	
				−·7					−·5
1600	90·4	− ·7	89·7		1810	74·7	+2·1	76·8	
				−·7					−·6
1610	89·2	− ·2	89·0		1820	74·9	+1·3	76·2	
				−·7					−·5
1620	87·9	+ ·4	88·3		1830	74·7	+1·0	75·7	
				−·7					−·5
1630	86·7	+ ·9	87·6		1840	74·7	+ ·5	75·2	
				−·7					−·5
1640	84·1	+2·8	86·9		1850	74·7	0	74·7	
				−·7					−·5
1650	84·2	+2·0	86·2		1860	74·5	− ·3	74·2	
				−·7					−·6
1660	84·6	+ ·9	85·5		1870	72·3	+1·3	73·6	
				−·7					−·5
1670	84·9	− ·1	84·8		1880	73·3	− ·2	73·1	
				−·6					−·5
1680	85·1	− ·9	84·2		1890	74·5	−1·9	72·6	
				−·6					−·5
1690	84·8	−1·2	83·6		1900	71·5	+ ·6	72·1	
				−·6					−·5
1700	84·5	−1·5	83·0		1910	71·6	0	71·6	
				−·6					−·4

REPORT VIII.—TABLE VI—*continued.*

Elongated Shot with Ogival Heads.

Velocity.	Mean Values of K_v, found by Experiment.	Correction.	Corrected Values of K_v.	Differences.	Velocity.	Mean Values of K_v, found by Experiment.	Correction.	Corrected Values of K_v.	Differences.
f. s.					f. s.				
1920	69·9	+1·3	71·2		2090	68·7	− ·9	67·8	
				− ·4					0
1930	69·5	+1·3	70·8		2100	68·8	−1·0	67·8	
				− ·4					− ·1
1940	69·0	+1·4	70·4		2110	68·6	− ·9	67·7	
				− ·4					− ·1
1950	68·9	+1·1	70·0		2120	68·4	− ·8	67·6	
				− ·3					0
1960	69·2	+ ·5	69·7		2130	68·3	− ·7	67·6	
				− ·3					− ·1
1970	68·8	+ ·6	69·4		2140	67·7	− ·2	67·5	
				− ·2					− ·1
1980	68·2	+1·0	69·2		2150	67·8	− ·4	67·4	
				− ·2					− ·1
1990	68·0	+1·0	69·0		2160	67·0	+ ·3	67·3	
				− ·2					− ·1
2000	68·2	+ ·6	68·8		2170	66·8	+ ·4	67·2	
				− ·2					0
2010	68·4	+ ·2	68·6		2180	66·8	+ ·4	67·2	
				− ·2					− ·1
2020	68·4	·0	68·4		2190	66·8	+ ·3	67·1	
				− ·1					− ·1
2030	68·2	+ ·1	68·3		2200	66·8	+ ·2	67·0	
				− ·1					− ·1
2040	68·0	+ ·2	68·2		2210	66·8	+ ·1	66·9	
				− ·1					− ·1
2050	67·8	+ ·3	68·1		2220	66·8	0	66·8	
				− ·1					− ·1
2060	67·6	+ ·4	68·0		2230	66·7	+ ·1	66·8	
				− ·1					0
2070	67·8	+ ·1	67·9		2240	66·9	− ·2	66·7	
				0					− ·1
2080	68·3	− ·4	67·9		2250	66·6	0	66·6	
				− ·1					

Report VIII.—Table VII.

Summary of the Values of K_v derived from each Round, for Velocities between 1640 f. s. and 1880 f. s.

Elongated Projectiles with Hemispherical Heads.

No. of Round.	K_v.
1640 f. s.	
467	107·3
468	128·8
469	112·3
	3)348·4
	116·1
1650 f. s.	
467	106·4
468	127·1
469	112·4
	3)345·9
	115·3
1660 f. s.	
467	105·6
468	125·5
469	112·5
	3)343·6
	114·5
1670 f. s.	
467	104·8
468	123·9
469	113·0
	3)341·7
	113·9
1680 f. s.	
467	106·4
468	123·9
469	113·4
	3)343·7
	114·6
1690 f. s.	
467	108·1
468	123·9
469	113·9
	3)345·9
	115·3
1700 f. s.	
467	106·8
468	123·9
469	113·6
	3)344·3
	114·8
1710 f. s.	
467	105·6
468	120·6
469	113·4
	3)339·6
	113·2
1720 f. s.	
467	106·4
468	117·3
469	113·1
	3)336·8
	112·3
1730 f. s.	
467	107·3
468	116·7
469	114·7
	3)338·7
	112·9
1740 f. s.	
467	108·1
468	116·2
469	116·4
	3)340·7
	113·6
1750 f. s.	
467	106·7
468	115·6
469	115·9
	3)338·2
	112·7
1760 f. s.	
467	105·4
468	110·9
469	115·3
	3)331·6
	110·5

REPORT VIII.—TABLE VII—*continued.*

Elongated Projectiles with Hemispherical Heads.

No. of Round.	K_v.	No. of Round.	K_v.	No. of Round.	K_v.
1770 f. s.		1810 f. s.		1850 f. s.	
467	104·0	467	106·4	467	105·6
468	106·1	468	100·6	468	86·4
469	114·8	469	114·0	469	111·2
	3)324·9		3)321·0		3)303·2
	108·3		107·0		101·1
1780 f. s.		1820 f. s.		1860 f. s.	
467	105·2	467	106·4	467	105·6
468	106·4	468	95·2	468	84·8
469	114·8	469	113·1	469	110·6
	3)326·4		3)314·7		3)301·0
	108·8		104·9		100·3
1790 f. s.		1830 f. s.		1870 f. s.	
467	106·4	467	106·1	467	105·6
468	104·5	468	89·8	468	81·4
469	114·8	469	112·3	469	111·3
	3)325·7		3)308·2		3)298·3
	108·6		102·7		99·4
1800 f. s.		1840 f. s.		1880 f. s.	
467	106·4	467	105·9	467	105·6
468	102·5	468	88·1	468	78·1
469	114·8	469	111·7	469	112·0
	3)323·7		3)305·7		3)295·7
	107·9		101·9		98·6

Report VIII.—Table VIII.

Corrected Mean Values of K_v from Table VII, for Intervals of 10 f. s in Velocity.

Elongated Shot with Hemispherical Heads.

Velocity.	Mean Values of K_v, found by Experiment.	Correction.	Corrected Values of K_v.	Differences.	Velocity.	Mean Values of K_v, found by Experiment.	Correction.	Corrected Values of K_v.	Differences.
f. s.					f. s.				
1640	116·1	− ·3	115·8		1770	108·3	+1·2	109·5	
				− ·3					− ·7
1650	115·3	+ ·2	115·5		1780	108·8	0	108·8	
				− ·3					− ·8
1660	114·5	+ ·7	115·2		1790	108·6	− 6	108·0	
				− ·4					− ·9
1670	113·9	+ ·9	114·8		1800	107·9	− ·8	107·1	
				− ·4					−1·0
1680	114·6	− ·2	114·4		1810	107·0	− ·9	106·1	
				− ·4					−1·0
1690	115·3	−1·3	114·0		1820	104·9	+ ·2	105·1	
				− ·4					−1·1
1700	114·8	−1·2	113·6		1830	102·7	+1·3	104·0	
				− ·5					−1·1
1710	113·2	− ·1	113·1		1840	101·9	+1·0	102·9	
				− ·5					−1·2
1720	112·3	+ ·3	112·6		1850	101·1	+ ·6	101·7	
				− ·6					−1·2
1730	112·9	− ·9	112·0		1860	100·3	+ ·2	100·5	
				− ·6					−1·2
1740	113·6	−2·2	111·4		1870	99·4	− ·1	99·3	
				− ·6					−1·2
1750	112·7	−1·9	110·8		1880	98·6	− ·5	98·1	
				− ·6					
1760	110·5	− ·8	110·2						
				− ·7					

Report VIII.—Table IX.

Summary of the Values of K_v derived from each Round, for Velocities between 1520 f. s. and 1870 f. s.

Elongated Projectiles with Flat Heads.

No. of Round.	K_v.	No. of Round.	K_v.	No. of Round.	K_v.
1520 f. s.		**1560 f. s.**		**1600 f. s.**	
465	187·2	465	185·1	464	167·0
466	158·8	466	163·2	465	182·6
	2)346·0		2)348·3	466	170·3
	173·0		174·2		3)519·9
					173·3
1530 f. s.		**1570 f. s.**		**1610 f. s.**	
465	186·5	465	184·7	464	166·2
466	159·6	466	165·1	465	181·8
	2)346·1		2)349·8	466	171·9
	173·1		174·9		3)519·9
					173·3
1540 f. s.		**1580 f. s.**		**1620 f. s.**	
465	185·9	465	184·3	464	165·3
466	160·5	466	167·0	465	181·4
	2)346·4		2)351·3	466	172·7
	173·2		175·7		3)519·4
					173·1
1550 f. s.		**1590 f. s.**		**1630 f. s.**	
465	185·5	465	188·5	464	164·5
466	161·3	466	168·6	465	181·0
	2)346·8		2)352·1	466	173·5
	173·4		176·1		3)519·0
					173·0

REPORT VIII.—TABLE IX—*continued.*

Elongated Projectiles with Flat Heads.

No. of Round.	K_v.	No. of Round.	K_v.	No. of Round.	K_v.
1640 f. s.		1690 f. s.		1740 f. s.	
464	165·1	464	165·4	464	163·1
465	180·6	465	176·8	465	172·8
466	174·4	466	180·2	466	179·5
	3)520·1		3)522·4		3)515·4
	173·4		174·1		171·8
1650 f. s.		1700 f. s.		1750 f. s.	
464	165·7	464	164·5	464	162·9
465	180·2	465	176·0	465	172·4
466	175·2	466	180·4	466	178·0
	3)521·1		3)520·9		3)513·3
	173·7		173·6		171·1
1660 f. s.		1710 f. s.		1760 f. s.	
464	166·4	464	163·7	464	164·1
465	179·4	465	175·2	465	172·0
466	176·5	466	180·6	466	176·5
	3)522·3		3)519·5		3)512·6
	174·1		173·2		170·9
1670 f. s.		1720 f. s.		1770 f. s.	
464	167·0	464	163·5	464	165·3
465	178·5	465	174·4	465	171·6
466	177·7	466	180·8	466	175·0
	3)523·2		3)518·7		3)511·9
	174·4		172·9		170·6
1680 f. s.		1730 f. s.		1780 f. s.	
464	166·2	464	163·3	464	166·6
465	177·7	465	173·6	465	171·2
466	179·0	466	181·0	466	173·5
	3)522·9		3)517·9		3)511·3
	174·3		172·6		170·4

REPORT VIII.—TABLE IX—*continued.*

Elongated Projectiles with Flat Heads.

No. of Round.	K_v.	No. of Round.	K_v.	No. of Round.	K_v.
1790 f. s.		1820 f. s.		1850 f. s.	
464	167·8	464	167·8	464	166·8
465	171·0	465	170·3	465	170·3
466	172·1	466	167·8	466	161·5
	3)510·9		3)505·9		3)498·6
	170·3		168·6		166·2
1800 f. s.		1830 f. s.		1860 f. s.	
464	167·8	464	167·8	464	166·3
465	170·7	465	170·3	465	170·3
466	170·6	466	165·7	466	159·3
	3)509·1		3)503·8		3)495·9
	169·7		167·9		165·3
1810 f. s.		1840 f. s.		1870 f. s.	
464	167·8	464	167·3	464	165·8
465	170·5	465	170·3	465	170·3
466	169·2	466	163·6	466	157·2
	3)507·5		3)501·2		3)493·3
	169·2		167·1		164·4

Report VIII.—Table X.

Corrected Mean Values of K_v from Table X, for Intervals of 10 f. s. in Velocity.

Elongated Projectiles with Flat Heads.

Velocity.	Values of K_v, found by Experiment.	Correction.	Corrected Values of K_v.	Differences.	Velocity.	Values of K_v, found by Experiment.	Correction.	Corrected Values of K_v.	Differences.
f. s.					f. s.				
1520	173·0	+ ·3	173·3		1700	173·6	− ·1	173·5	
				+ ·3					− ·3
1530	173·1	+ ·5	173·6		1710	173·2	0	173·2	
				+ ·2					− ·3
1540	173·2	+ ·6	173·8		1720	172·9	0	172·9	
				+ ·1					− ·4
1550	173·4	+ ·5	173·9		1730	172·6	− ·1	172·5	
				+ ·1					− ·4
1560	174·2	− ·2	174·0		1740	171·8	+ ·3	172·1	
				+ ·1					− ·4
1570	174·9	− ·8	174·1		1750	171·1	+ ·6	171·7	
				+ ·1					− ·5
1580	175·7	−1·5	174·2		1760	170·9	+ ·3	171·2	
				+ ·1					− ·5
1590	176·1	−1·8	174·3		1770	170·6	+ ·1	170·7	
				+ ·1					− ·5
1600	173·3	+1·1	174·4		1780	170·4	− ·2	170·2	
				+ ·1					− ·5
1610	173·3	+1·2	174·5		1790	170·3	− ·6	169·7	
				0					− ·6
1620	173·1	+1·4	174·5		1800	169·7	− ·6	169·1	
				0					− ·5
1630	173·0	+1·5	174·5		1810	169·2	− ·6	168·6	
				0					− ·6
1640	173·4	+1·1	174·5		1820	168·6	− ·6	168·0	
				− ·1					− ·6
1650	173·7	+ ·7	174·4		1830	167·9	− ·5	167·4	
				− ·1					− ·6
1660	174·1	+ ·2	174·3		1840	167·1	− ·3	166·8	
				− ·1					− ·6
1670	174·4	− ·2	174·2		1850	166·2	0	166·2	
				− ·2					− ·6
1680	174·3	− ·3	174·0		1860	165·3	+ ·3	165·6	
				− ·2					− ·6
1690	174·1	− ·3	173·8		1870	164·4	+ ·6	165·0	
				− ·3					

APPENDIX TO REPORT VIII.

THE following tables have been prepared from the results of the experiments of 1867–68 and 1878–79, in order to render the results practically useful.

Table I gives the values of K_v, $\frac{K_v}{g}$ and $\Sigma\frac{K_v}{g}$ for intervals of 5 f.s. for velocities 430 to 2250 f. s. for ogival-headed projectiles.

Table II gives the resistance of the air in lbs. to ogival-headed shot of diameters 1 to 20 inches, when moving with a velocity between 450 and 2250 f. s..

Tables III and IV give the values of $\frac{d^2}{w}t$ and of $\frac{d^2}{w}s$, for velocities 430 to 2500 f. s., which are to be used as follows. Let V denote the initial velocity, and v the velocity of an ogival-headed shot (of which the diameter is d inches, and weight w lbs.) after it has moved in an approximately straight line in t seconds through a space s feet. Let T_v denote the tabular number corresponding to the velocity v in Table III; and S_v that in Table IV. Then we have

$$\frac{d^2}{w}t = T_V - T_v \qquad (1)$$

$$\frac{d^2}{w}s = S_V - S_v \qquad (2)$$

In equation (1) we have V, v and t so connected that two of these quantities being given the third can be found; and in equation (2) V, v and s are so connected that two of these being given the remaining quantity can be found by the help of the tables.

For example, suppose that an ogival-headed shot, weighing 250 lbs., is fired from a 9-inch gun with an initial velocity of 1327 f. s.: Required the velocity at the distance of 300 yards, and the time of flight. Here $V = 1327$ f.s.; $w = 250$ lbs.; $d = 8{\cdot}92$ inches; and therefore $\frac{d^2}{w} = {\cdot}3183$; $s = 300$ yards $= 900$ feet.

By equation (2) $S_v = S_V - \frac{d^2}{w}s$

$$= S_{1327} - {\cdot}3183 \times 900$$
$$= 22323{\cdot}5 - 286{\cdot}5$$
$$= 22037{\cdot}0 = S_{1274{\cdot}5}$$

Therefore $v = 1274{\cdot}5$ f. s.

Again, by equation (1) $\frac{d^2}{w}t = T_V - T_v$

or, $${\cdot}3183 \times t = T_{1327} - T_{1274{\cdot}5}$$
$$= 31{\cdot}7173 - 31{\cdot}4971$$
$$= 0{\cdot}2202$$

or, $$t = 0''{\cdot}6918$$

The arrangement of the following tables differs from all others I have previously calculated, in that S and T increase in numerical magnitude as v increases, and consequently dT, dS, and dv have always the same sign. This arrangement supposes the force to be *accelerating* instead of *retarding*, but that is of no moment, as we make use only of the differences of the pairs of tabular numbers T_v and T_v; S_v and S_v. The mean difference of successive tabular numbers in each line has been given opposite that line.

It unfortunately happens that the equation between *time* and *space* does not admit of the formation of a general table connecting them directly together. Hence the above double process is necessary when it is required to find *what space* would be described by a shot in a *given time*, or, in *what time* a shot would describe a *given space*.

For a description of the formation of these general tables, and for practical applications of them, see my treatise on the Motion of Projectiles, p. 69; and also, Principles of Gunnery, by Major Sladen, R.A., Professor of Artillery in the R.M. Academy, Woolwich.

As already stated, the weight of a cubic foot of air has been supposed to be 534·22 grains, which is the weight of a cubic foot of dry air at a temperature 62° F., under a pressure of 30 inches of mercury. When the range is considerable, and the weight of the air differs sensibly from 534·22 grains per cubic foot, this difference ought to be taken into account.

Appendix to Report VIII.—Table I.

Coefficients for the Cubic Law of the Resistance of the Air to Ogival-headed Shot.

$g = 32{\cdot}1908.$

v.	K_v.	$\frac{K_v}{g}$.	$\Sigma\frac{K_v}{g}$.	v.	K_v.	$\frac{K_v}{g}$.	$\Sigma\frac{K_v}{g}$.
f. s.				f. s.			
430	139·8	4·343	504·34	670	89·1	2·768	670·42
435	138·5	4·303	508·65	675	88·4	2·746	673·17
440	137·2	4·262	512·91	680	87·7	2·724	675·89
445	135·9	4·222	517·13	685	87·0	2·703	678·59
450	134·6	4·181	521·31	690	86·3	2·681	681·27
455	133·3	4·141	525·45	695	85·6	2·659	683·93
460	132·0	4·101	529·55	700	84·9	2·637	686·57
465	130·7	4·060	533·61	705	84·3	2·619	689·19
470	129·4	4·020	537·63	710	83·7	2·600	691·79
475	128·2	3·983	541·62	715	83·1	2·581	694·37
480	126·9	3·942	545·56	720	82·6	2·566	696·94
485	125·7	3·905	549·46	725	82·1	2·550	699·49
490	124·4	3·865	553·33	730	81·6	2·535	702·02
495	123·2	3·827	557·16	735	81·1	2·519	704·54
500	121·9	3·787	560·94	740	80·6	2·504	707·04
505	120·7	3·750	564·69	745	80·1	2·488	709·53
510	119·6	3·715	568·41	750	79·6	2·473	712·00
515	118·4	3·678	572·09	755	79·1	2·457	714·46
520	117·3	3·644	575·73	760	78·7	2·445	716·91
525	116·1	3·607	579·34	765	78·3	2·432	719·34
530	115·0	3·573	582·91	770	78·0	2·423	721·76
535	113·9	3·538	586·45	775	77·7	2·414	724·18
540	112·8	3·504	589·95	780	77·4	2·404	726·58
545	111·8	3·473	593·42	785	77·1	2·395	728·97
550	110·7	3·439	596·86	790	76·8	2·386	731·36
555	109·7	3·408	600·27	795	76·5	2·376	733·74
560	108·7	3·377	603·65	800	76·2	2·367	736·10
565	107·7	3·346	606·99	805	75·9	2·358	738·46
570	106·7	3·315	610·31	810	75·6	2·348	740·81
575	105·7	3·284	613·59	815	75·4	2·342	743·15
580	104·6	3·249	616·84	820	75·2	2·336	745·49
585	103·6	3·218	620·06	825	75·1	2·333	747·82
590	102·5	3·184	623·24	830	75·1	2·333	750·15
595	101·5	3·153	626·40	835	75·0	2·330	752·48
600	100·5	3·122	629·52	840	75·0	2·330	754·81
605	99·5	3·091	632·61	845	75·0	2·330	757·14
610	98·6	3·063	635·67	850	75·0	2·330	759·47
615	97·7	3·035	638·71	855	75·0	2·330	761·80
620	96·8	3·007	641·72	860	75·0	2·330	764·13
625	95·9	2·979	444·69	865	75·0	2·330	766·46
630	95·1	2·954	647·65	870	75·0	2·330	768·79
635	94·3	2·929	650·58	875	75·0	2·330	771·12
640	93·5	2·905	653·48	880	75·0	2·330	773·45
645	92·7	2·880	656·36	885	75·0	2·330	775·78
650	91·9	2·855	659·22	890	75·0	2·330	778·11
655	91·2	2·833	662·05	895	75·0	2·330	780·44
660	90·5	2·811	664·86	900	75·0	2·330	782·77
665	89·8	2·790	667·65	905	75·0	2·330	785·10

APPENDIX TO REPORT VIII.—TABLE I—*continued.*

$g = 32{\cdot}1908.$

$v.$	$K_v.$	$\frac{K_v.}{g}$	$\Sigma\frac{K_v.}{g}$	$v.$	$K_v.$	$\frac{K_v.}{g}$	$\Sigma\frac{K_v.}{g}$
f. s.				f. s.			
910	75·0	2·330	787·43	1200	109·6	3·405	952·87
915	75·0	2·330	789·76	1205	109·6	3·405	956·28
920	75·0	2·330	792·09	1210	109·6	3·405	959·69
925	75·0	2·330	794·42	1215	109·6	3·405	963·09
930	75·0	2·330	796·75	1220	109·6	3·405	966·49
935	75·0	2·330	799·08	1225	109·6	3·405	969·90
940	75·0	2·330	801·41	1230	109·5	3·402	973·30
945	75·0	2·330	803·74	1235	109·5	3·402	976·70
950	75·0	2·330	806·07	1240	109·5	3·402	980·10
955	75·0	2·330	808·40	1245	109·5	3·402	983·50
960	75·0	2·330	810·73	1250	109·4	3·398	986·90
965	75·0	2·330	813·06	1255	109·4	3·398	990·30
970	75·0	2·330	815·39	1260	109·3	3·395	993·69
975	75·0	2·330	817·72	1265	109·3	3·395	997·09
980	75·0	2·330	820·05	1270	109·2	3·392	1000·48
985	75·0	2·330	822·38	1275	109·1	3·389	1003·87
990	75·0	2·330	824·71	1280	109·0	3·386	1007·26
995	75·0	2·330	827·04	1285	108·9	3·383	1010·64
1000	75·0	2·330	829·37	1290	108·8	3·380	1014·02
1005	75·0	2·330	831·70	1295	108·7	3·377	1017·40
1010	75·1	2·333	834·04	1300	108·6	3·374	1020·77
1015	75·2	2·336	836·37	1305	108·5	3·371	1024·14
1020	75·3	2·339	838·71	1310	108·4	3·367	1027·51
1025	75·7	2·352	841·06	1315	108·2	3·361	1030·87
1030	76·7	2·383	843·45	1320	108·1	3·358	1034·23
1035	78·4	2·435	845·88	1325	107·9	3·352	1037·58
1040	80·8	2·510	848·39	1330	107·8	3·349	1040·93
1045	83·8	2·603	850·99	1335	107·6	3·343	1044·27
1050	87·3	2·712	853·71	1340	107·5	3·339	1047·61
1055	90·8	2·821	856·53	1345	107·3	3·333	1050·94
1060	94·0	2·920	859·45	1350	107·1	3·327	1054·27
1065	96·6	3·001	862·45	1355	106·9	3·321	1057·59
1070	98·7	3·066	865·51	1360	106·7	3·315	1060·91
1075	100·6	3·125	868·64	1365	106·5	3·308	1064·21
1080	102·2	3·175	871·81	1370	106·3	3·302	1067·52
1085	103·7	3·221	875·04	1375	106·0	3·293	1070·81
1090	104·9	3·259	878·29	1380	105·8	3·287	1074·10
1095	105·9	3·290	881·58	1385	105·5	3·277	1077·37
1100	106·9	3·321	884·91	1390	105·3	3·271	1080·64
1105	107·8	3·349	888·25	1395	105·0	3·262	1083·91
1110	108·4	3·367	891·62	1400	104·7	3·252	1087·16
1115	108·8	3·380	895·00	1405	104·4	3·243	1090·40
1120	109·2	3·392	898·39	1410	104·1	3·234	1093·64
1125	109·5	3·402	901·80	1415	103·8	3·225	1096·86
1130	109·6	3·405	905·20	1420	103·5	3·215	1100·08
1135	109·6	3·405	908·61	1425	103·2	3·206	1103·28
1140	109·6	3·405	912·01	1430	102·9	3·197	1106·48
1145	109·6	3·405	915·42	1435	102·6	3·187	1109·67
1150	109·6	3·405	918·82	1440	102·3	3·178	1112·84
1155	109·6	3·405	922·23	1445	101·9	3·166	1116·01
1160	109·6	3·405	925·63	1450	101·6	3·156	1119·17
1165	109·6	3·405	929·04	1455	101·2	3·144	1122·31
1170	109·6	3·405	932·44	1460	100·9	3·134	1125·44
1175	109·6	3·405	935·85	1465	100·5	3·122	1128·57
1180	109·6	3·405	939·25	1470	100·1	3·110	1131·68
1185	109·6	3·405	942·66	1475	99·7	3·097	1134·77
1190	109·6	3·405	946·06	1480	99·4	3·088	1137·86
1195	109·6	3·405	949·47	1485	99·0	3·075	1140·94

APPENDIX TO REPORT VIII.—TABLE I—*continued.*

$g = 32{\cdot}1908.$

$v.$	$K_v.$	$\frac{K_v.}{g}$	$\Sigma\frac{K_v.}{g}$	$v.$	$K_v.$	$\frac{K_v.}{g}$	$\Sigma\frac{K_v.}{g}$
f s.				f. s.			
1490	98·6	3·063	1144·00	1780	78·4	2·435	1301·64
1495	98·3	3·054	1147·05	1785	78·1	2·426	1304·07
1500	97·9	3·041	1150·09	1790	77·8	2·417	1306·49
1505	97·5	3·029	1153·12	1795	77·6	2·411	1308·90
1510	97·1	3·016	1156·14	1800	77·3	2·401	1311·30
1515	96·6	3·001	1159·14	1805	77·1	2·395	1313·69
1520	96·2	2·988	1162·13	1810	76·8	2·386	1316·08
1525	95·7	2·973	1165·10	1815	76·5	2·376	1318·46
1530	95·3	2·960	1168·06	1820	76·2	2·367	1320·82
1535	94·8	2·945	1171·01	1825	76·0	2·361	1323·18
1540	94·4	2.933	1173·94	1830	75·7	2·352	1325·54
1545	94·0	2·920	1176·86	1835	75·5	2·345	1327·88
1550	93·6	2·908	1179·77	1840	75·2	2·336	1330·22
1555	93·2	2·895	1182·66	1845	75·0	2·330	1332·55
1560	92·8	2·883	1185·54	1850	74·7	2·321	1334·87
1565	92·4	2·870	1188·41	1855	74·5	2·314	1337·18
1570	92·0	2·858	1191·27	1860	74·2	2·305	1339·49
1575	91·6	2·846	1194·12	1865	73·9	2·296	1341·78
1580	91·2	2·833	1196·95	1870	73·6	2·286	1344·07
1585	90·8	2·821	1199·77	1875	73·4	2·280	1346·35
1590	90·4	2·808	1202·58	1880	73·1	2·271	1348·62
1595	90·0	2·796	1205·38	1885	72·9	2·265	1350·88
1600	89·7	2·787	1208·16	1890	72·6	2·255	1353·14
1605	89·3	2·774	1210·94	1895	72·4	2·249	1355·39
1610	89·0	2·765	1213·70	1900	72·1	2·240	1357·63
1615	88·6	2·752	1216·46	1905	71·9	2·234	1359·86
1620	88·3	2·743	1219·20	1910	71·6	2·224	1362·09
1625	87·9	2·731	1221·93	1915	71·4	2·218	1364·30
1630	87·6	2·721	1224·65	1920	71·2	2·212	1366·52
1635	87·2	2·709	1227·36	1925	71·0	2·206	1368·72
1640	86·9	2·700	1230·06	1930	70·8	2·199	1370·92
1645	86·5	2·687	1232·75	1935	70·6	2·193	1373·11
1650	86·2	2·678	1235·42	1940	70·4	2·187	1375·30
1655	85·8	2·665	1238·09	1945	70·2	2·181	1377·48
1660	85·5	2·656	1240·75	1950	70·0	2·175	1379·66
1665	85·1	2·644	1243·39	1955	69·8	2·168	1381·83
1670	84·8	2·634	1246·02	1960	69·7	2·165	1383·99
1675	84·5	2·625	1248·65	1965	69·5	2·159	1386·15
1680	84·2	2·616	1251·26	1970	69·4	2·156	1388·31
1685	83·9	2·606	1253·87	1975	69·3	2·153	1390·46
1690	83·6	2·597	1256·47	1980	69·2	2·150	1392·61
1695	83·3	2·588	1259·05	1985	69·1	2·147	1394·76
1700	83·0	2·578	1261·63	1990	69·0	2·143	1396·90
1705	82·7	2·569	1264·20	1995	68·9	2·140	1399·04
1710	82·4	2·560	1266·76	2000	68·8	2·137	1401·18
1715	82·1	2·550	1269·31	2005	68·7	2·134	1403·31
1720	81·8	2·541	1271·85	2010	68·6	2·131	1405·44
1725	81·5	2·532	1274·38	2015	68·5	2·128	1407·57
1730	81·2	2·522	1276·91	2020	68·4	2·125	1409·69
1735	80·9	2·513	1279·42	2025	68·4	2·125	1411·82
1740	80·6	2·504	1281·92	2030	68·3	2·122	1413·94
1745	80·3	2·495	1284·42	2035	68·3	2·122	1416·06
1750	80·0	2·485	1286·90	2040	68·2	2·119	1418·18
1755	79·8	2·479	1289·38	2045	68·2	2·119	8420·30
1760	79·5	2·470	1291·85	2050	68·1	2·116	1422·42
1765	79·2	2·460	1294·31	2055	68·1	2·116	1424·53
1770	78·9	2·451	1296·76	2060	68·0	2·112	1426·64
1775	78·7	2·445	1299·21	2065	68·0	2·112	1428·76

APPENDIX TO REPORT VIII.—TABLE I—*continued.*

$g = 32{\cdot}1908.$

$v.$	$K_v.$	$\frac{K_v.}{g}$	$\Sigma\frac{K_v.}{g}$	$v.$	$K_v.$	$\frac{K_v.}{g}$	$\Sigma\frac{K_v.}{g}$
f. s.				f. s.			
2070	67·9	2·109	1430·87	2165	67·2	2·088	1470·77
2075	67·9	2·109	1432·97	2170	67·2	2·088	1472·86
2080	67·9	2·109	1435·08	2175	67·2	2·088	1474·94
2085	67·8	2·106	1437·19	2180	67·2	2·088	1477·03
2090	67·8	2·106	1439·30	2185	67·1	2·084	1479·12
2095	67·8	2·106	1441·40	2190	67 1	2·084	1481·20
2100	67·8	2·106	1443·51	2195	67·0	2 081	1483·28
2105	67·7	2·103	1445·61	2200	67·0	2·081	1485·36
2110	67·7	2·103	1447·71	2205	66·9	2·078	1487·44
2115	67·7	2·103	1449·82	2210	66·9	2·078	1489·52
2120	67·6	2·100	1451·92	2215	66·8	2·075	1491·59
2125	67·6	2·100	1454·02	2220	66·8	2·075	1493·67
2130	67·6	2·100	1456·12	2225	66·8	2·075	1495·74
2135	67·5	2·097	1458·21	2230	66·8	2·075	1497·82
2140	67·5	2·097	1460·31	2235	66·7	2·072	1499·89
2145	67·4	2·094	1462·40	2240	66·7	2·072	1501·96
2150	67·4	2·094	1464·50	2245	66·6	2·069	1504·03
2155	67·3	2·091	1466·59	2250	66·6	2·069	1506·10
2160	67·3	2·091	1468·68				

Appendix to Report VIII.—Table II.

Table showing the Resistance of the Air in pounds to Ogival-headed Shot, from one to twenty inches in Diameter, for specified Velocities.

v.	1 in.	2 in.	3 in.	4 in.	5 in.	6 in.	7 in.	8 in.	9 in.	10 in.	11 in.	12 in.	13 in.	14 in.	15 in.	16 in.	17 in.	18 in.	19 in.	20 in.	v.
f. s.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	f. s.
450	0·381	1·5	3	6		14	19	24	31	38	46	55	64	75	86	98	110	123	138	152	450
500	0·473	1·9	4	8	12	17	23	30	38	47	57	68	80	93	106	121	137	153	171	189	500
550	0·572	2·3	5	9	14	20	28	36	46	57	69	82	97	112	129	146	165	185	206	229	550
600	0·674	2·7	6	11	17	24	33	43	55	67	82	97	114	132	152	173	195	218	243	270	600
650	0·784	3·1	7	13	20	28	38	50	64	78	95	113	132	154	176	203	227	254	283	314	650
700	0·905	3·6	8	14	23	33	44	58	73	91	110	130	153	177	204	232	262	293	327	362	700
750	1·043	4·2	9	17	26	38	51	67	84	104	126	150	176	204	235	267	301	338	377	417	750
800	1·212	4·8	11	19	30	44	59	78	98	121	147	175	205	238	273	310	350	393	438	485	800
850	1·430	5·7	13	23	36	51	70	92	116	143	173	206	242	280	322	366	413	463	516	572	850
900	1·698	6·8	15	27	42	61	83	109	138	170	205	245	287	333	382	435	491	550	613	679	900
950	1·997	8·0	19	32	50	72	98	128	162	200	242	288	337	391	449	511	577	647	721	799	950
1000	2·329	9·3	21	37	58	84	114	149	189	233	282	335	394	456	524	596	673	755	841	932	1000
1050	3·140	12·5	28	50	79	113	154	201	254	314	380	452	531	615	707	804	907	1017	1134	1256	1050
1100	4·420	17·7	40	71	111	159	217	283	358	442	535	636	747	866	995	1132	1277	1432	1596	1768	1100
1150	5·179	20·7	47	83	129	186	254	331	419	518	627	746	875	1015	1165	1326	1497	1678	1870	2072	1150
1200	5·884	23·5	53	94	147	212	288	377	477	588	712	847	994	1153	1324	1506	1700	1906	2124	2354	1200
1250	6·637	26·5	60	106	166	239	325	425	538	664	803	956	1122	1301	1493	1699	1918	2150	2396	2655	1250
1300	7·413	29·7	67	119	185	267	363	474	600	741	897	1067	1253	1453	1668	1898	2142	2402	2676	2965	1300

Table showing the Resistance of the Air in pounds to Ogival-headed Shot, from one to twenty inches in Diameter, for specified Velocities.

v.	1 in.	2 in.	3 in.	4 in.	5 in.	6 in.	7 in.	8 in.	9 in.	10 in.	11 in.	12 in.	13 in.	14 in.	15 in.	16 in.	17 in.	18 in.	19 in.	20 in.	*v.*
f. s.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	f. s.
1350	8·186	32·7	74	131	205	295	401	524	663	819	991	1179	1383	1604	1842	2096	2366	2652	2955	3274	1350
1400	8·924	35·7	80	143	223	321	437	571	723	892	1080	1285	1508	1749	2008	2285	2579	2891	3222	3570	1400
1450	9·621	38·5	87	154	241	346	471	616	779	962	1164	1385	1626	1886	2165	2463	2780	3117	3473	3848	1450
1500	10·263	41·1	92	164	257	369	503	657	831	1026	1242	1478	1734	2012	2309	2627	2966	3325	3705	4105	1500
1550	10·829	43·3	97	173	271	390	531	693	877	1083	1310	1559	1830	2122	2437	2772	3130	3509	3909	4332	1550
1600	11·416	45·7	103	183	285	411	559	731	925	1142	1381	1644	1929	2238	2569	2922	3299	3699	4121	4566	1600
1650	12·030	48·1	108	192	301	433	589	770	974	1203	1456	1732	2033	2358	2707	3080	3477	3898	4343	4812	1650
1700	12·666	50·7	114	203	317	456	621	811	1026	1267	1533	1824	2141	2483	2850	3242	3660	4104	4572	5066	1700
1750	13·318	53·3	120	213	333	479	653	852	1079	1332	1611	1918	2251	2610	2997	2409	3849	4315	4808	5327	1750
1800	14·003	56·0	126	224	350	504	686	896	1134	1400	1694	2016	2367	2745	3151	3585	4047	4537	5055	5601	1800
1850	14·689	58·8	132	235	367	529	720	940	1190	1469	1777	2115	2482	2879	3305	3760	4245	4759	5303	5876	1850
1900	15·364	61·5	138	246	384	553	753	983	1244	1536	1859	2212	2597	3011	3457	3933	4440	4978	5546	6146	1909
1950	16·127	64·5	145	258	403	581	790	1032	1306	1613	1951	2322	2725	3161	3629	4129	4661	5225	5822	6451	1950
2000	17·096	68·4	154	274	427	615	838	1093	1385	1710	2069	2462	2889	3351	3847	4377	4941	5539	6172	6838	2000
2050	18·230	72·9	164	292	456	656	893	1167	1477	1823	2206	2625	3081	3573	4102	4667	5268	5907	6581	7292	2050
2100	19·504	78·0	176	312	488	702	956	1248	1580	1950	2360	2809	3296	3823	4388	4993	5637	6319	7041	7802	2100
2150	20·811	83·2	187	333	520	749	1020	1332	1686	2081	2518	2997	3517	4079	4682	5328	6014	6743	7513	8324	2150
2200	22·159	88·6	199	355	554	798	1086	1418	1795	2216	2681	3191	3745	4343	4986	5673	6404	7180	7999	8864	2200
2250	23·567	94·3	212	377	589	848	1155	1508	1909	2357	2852	3393	3983	4619	5303	6033	6811	7636	8508	9427	2250

Appendix to Report VIII.—Table III.

A General Table of Values of $\frac{d^2}{w}t$ for Ogival-headed Shot.

v.	0	1	2	3	4	5	6	7	8	9	Diff.
f.s.	secs.	secs.	secs.	secs.	se s.	secs.	secs.	secs.	secs.	secs.	
40	5·0000	5·1052	5·2099	5·3140	5·4175	5·5206	5·6230	5·7250	5·8264	5·9273	·1027
41	6·0276	6·1275	6·2268	6·3256	6·4238	6·5216	6·6188	6·7155	6·8117	6·9075	·0975
42	7·0027	7·0974	7·1916	7·2854	7·3786	7·4714	7·5637	7·6556	7·7470	7·8379	·0925
43	7·9283	8·0183	8·1078	8·1969	8·2855	8·3737	8·4614	8·5487	8·6355	8·7219	·0879
44	8·8079	8·8935	8·9786	9·0633	9·1476	9·2315	9·3150	9·3981	9·4808	9·5631	·0837
45	9·6451	9·7266	9·8077	9·8885	9·9689	*0·0488	*0·1285	*0·2077	*0·2866	*0·3651	·0798
46	10·4433	0·5211	0·5986	0·6757	0·7525	0·8289	0·9049	0·9807	1·0560	1·1311	·0762
47	11·2058	1·2803	1·3544	1·4281	1·5016	1·5747	1·6475	1·7200	1·7922	1·8641	·0730
48	11·9357	2·0069	2·0779	2·1486	2·2189	2·2890	2·3588	2·4283	2·4975	2·5664	·0699
49	12·6350	2·7033	2·7713	2·8391	2·9066	2·9738	3·0408	3·1075	3·1739	3·2401	·0670
50	13·3060	3·3716	3·4369	3·5020	3·5669	3·6315	3·6958	3·7598	3·8236	3·8872	·0644
51	13·9505	4·0135	4·0763	4·1389	4·2012	4·2632	4·3250	4·3866	4·4479	4·5090	·0619
52	14·5699	4·6305	4·6909	4·7511	4·8110	4·8708	4·9303	4·9896	5·0486	5·1075	·0596
53	15·1661	5·2245	5·2827	5·3407	5·3985	5·4560	5·5133	5·5705	5·6274	5·6841	·0574
54	15·7406	5·7969	5·8530	5·9089	5·9646	6·0201	6·0754	6·1304	6·1853	6·2400	·0553
55	16·2945	6·3488	6·4029	6·4568	6·5105	6·5641	6·6174	6·6705	6·7235	6·7762	·0534
56	16·8288	6·8812	6·9334	6·9854	7·0373	7·0890	7·1405	7·1918	7·2430	7·2940	·0516
57	17·3448	7·3955	7·4460	7·4963	7·5464	7·5964	7·6462	7·6959	7·7454	7·7947	·0499
58	17·8438	7·8928	7·9417	7·9904	8·0389	8·0873	8·1356	8·1837	8·2316	8·2794	·0483
59	18·3271	8·3746	8·4220	8·4692	8·5163	8·5632	8·6100	8·6565	8·7031	8·7494	·0468
60	18·7957	8·8417	8·8877	8·9334	8·9791	9·0246	9·0700	9·1152	9·1603	9·2052	·0454
61	19·2501	9·2947	9·3393	9·3837	9·4280	9·4721	9·5161	9·5600	9·6037	9·6473	·0441
62	19·6908	9·7341	9·7773	9·8204	9·8633	9·9062	9·9489	9·9914	*0·0338	*0·0761	·0428
63	20·1183	0·1604	0·2023	0·2441	0·2858	0·3273	0·3687	0·4100	0·4512	0·4922	·0415
64	20·5332	0·5740	0·6147	0·6552	0·6957	0·7360	0·7762	0·8163	0·8563	0·8962	·0403
65	20·9359	0·9755	1·0151	1·0544	1·0937	1·1328	1·1718	1·2107	1·2495	1·2881	·0391
66	21·3267	1·3651	1·4034	1·4416	1·4797	1·5177	1·5555	1·5933	1·6309	1·6684	·0379
67	21·7059	1·7432	1·7804	1·8175	1·8545	1·8914	1·9281	1·9648	2·0014	2·0378	·0368
68	22·0742	2·1105	2·1466	2·1827	2·2186	2·2545	2·2902	2·3259	2·3614	2·3969	·0358
69	22·4322	2·4675	2·5027	2·5377	2·5727	2·6076	2·6424	2·6771	2·7117	2·7462	·0348
70	22·7806	2·8150	2·8492	2·8833	2·9174	2·9513	2·9852	3·0189	3·0526	3·0862	·0339
71	23·1196	3·1530	3·1863	3·2195	3·2526	3·2856	3·3185	3·3513	3·3840	3·4167	·0330
72	23·4492	3·4816	3·5140	3·5462	3·5784	3·6105	3·6424	3·6743	3·7061	3·7378	·0320
73	23·7694	3·8009	3·8323	3·8636	3·8949	3·9260	3·9571	3·9881	4·0189	4·0497	·0311
74	24·0804	4·1110	4·1416	4·1720	4·2024	4·2326	4·2628	4·2929	4·3230	4·3529	·0302
75	24·3828	4·4125	4·4422	4·4719	4·5014	4·5308	4·5602	4·5895	4·6187	4·6478	·0294
76	24·6769	4·7058	4·7347	4·7635	4·7922	4·8208	4·8493	4·8777	4·9060	4·9343	·0286
77	24·9624	4·9905	5·0185	5·0464	5·0742	5·1020	5·1296	5·1572	5·1847	5·2121	·0277
78	25·2394	5·2666	5·2937	5·3208	5·3478	5·3747	5·4015	5·4282	5·4549	5·4814	·0268
79	25·5079	5·5343	5·2606	5·5869	5·6130	5·6391	5·6652	5·6911	5·7170	5·7428	·0261
80	25·7685	5·7941	5·8197	5·8452	5·8706	5·8959	5·9212	5·9463	5·9714	5·9965	·0253
81	26·0214	6·0463	6·0711	6·0959	6·1205	6·1451	6·1696	6·1941	6·2184	6·2427	·0245
82	26·2669	6·2910	6·3151	6·3390	6·3629	6·3867	6·4104	6·4340	6·4576	6·4810	·0237
83	26·5044	6·5277	6·5509	6·5740	6·5971	6·6201	6·6430	6·6658	6·6885	6·7111	·0229
84	26·7337	6·7562	6·7786	6·8009	6·8232	6·8454	6·8675	6·8895	6·9114	6·9333	·0221
85	26·9551	6·9768	6·9984	7·0200	7·0415	7·0629	7·0842	7·1055	7·1267	7·1478	·0214
86	27·1688	7·1898	7·2107	7·2315	7·2522	7·2729	7·2935	7·3140	7·3345	7·3549	·0206
87	27·3752	7·3954	7·4156	7·4357	7·4558	7·4757	7·4956	7·5155	7·5353	7·5550	·0199
88	27·5746	7·5942	7·6137	7·6332	7·6526	7·6719	7·6912	7·7104	7·7295	7·7486	·0193
89	27·7677	7·7866	7·8055	7·8244	7·8431	7·8618	7·8805	7·8991	7·9176	7·9360	·0187
90	27·9544	7·9727	7·9909	8·0091	8·0272	8·0452	8·0632	8·0812	8·0990	8·1168	·0180
91	28·1346	8·1523	8·1699	8·1875	8·2050	8·2225	8·2399	8·2573	8·2746	8·2918	·0174
92	28·3090	8·3261	8·3432	8·3602	8·3772	8·3941	8·4109	8·4277	8·4445	8·4611	·0169
93	28·4778	8·4943	8·5109	8·5273	8·5437	8·5601	8·5764	8·5927	8·6089	8·6250	·0163
94	28·6411	8·6572	8·6732	8·6892	8·7051	8·7209	8·7367	8·7525	8·7682	8·7838	·0158
95	28·7994	8·8150	8·8305	8·8459	8·8613	8·8767	8·8920	8·9073	8·9225	8·9376	·0153
96	28·9528	8·9678	8·9828	8·9978	9·0128	9·0276	9·0425	9·0573	9·0720	9·0867	·0149
97	29·1014	9·1160	9·1306	9·1451	9·1595	9·1740	9·1884	9·2027	9·2170	9·2312	·0144
98	29·2454	9·2596	9·2737	9·2878	9·3018	9·3158	9·3298	9·3437	9·3575	9·3713	·0140
99	29·3851	9·3989	9·4126	9·4262	9·4398	9·4534	9·4670	9·4805	9·4939	9·5073	·0136

Appendix to Report VIII.—Table III—*continued.*

A General Table of Values of $\frac{d^2}{w}t$ for Ogival-headed Shot.

v.	0	1	2	3	4	5	6	7	8	9	Diff.
f.s.	secs.	secs.	secs.	secs.	secs.	secs.	secs.	secs.	secs.	secs.	
100	29·5207	·5340	·5473	·5606	·5738	·5869	·6001	·6132	·6262	·6392	·0132
101	29·6522	·6651	·6780	·6908	·7036	·7164	·7291	·7418	·7544	·7670	·0127
102	29·7796	·7921	·8046	·8170	·8294	·8417	·8540	·8662	·8783	·8904	·0123
103	29·9024	·9144	·9262	·9380	·9496	·9612	·9727	·9841	·9954	*·0066	·0115
104	30·0177	·0287	·0396	·0504	·0610	·0716	·0820	·0923	·1025	·1126	·0105
105	30·1226	·1325	·1423	·1520	·1615	·1710	·1804	·1897	·1988	·2079	·0094
106	30·2170	·2259	·2347	·2435	·2522	·2609	·2694	·2780	·2864	·2948	·0086
107	30·3031	·3114	·3196	·3278	·3359	·3439	·3520	·3599	·3678	·3757	·0080
108	30·3835	·3913	·3990	·4067	·4143	·4219	·4295	·4370	·4445	·4519	·0076
109	30·4593	·4667	·4740	·4813	·4885	·4958	·5030	·5101	·5172	·5243	·0072
110	30·5314	·5384	·5454	·5524	·5593	·5662	·5731	·5800	·5868	·5936	·0069
111	30·6004	·6071	·6139	·6206	·6272	·6339	·6405	·6471	·6537	·6603	·0066
112	30·6668	·6733	·6798	·6863	·6928	·6992	·7056	·7120	·7184	·7248	·0064
113	30·7311	·7374	·7437	·7500	·7563	·7625	·7688	·7750	·7812	·7874	·0062
114	30·7936	·7997	·8059	·8120	·8181	·8242	·8303	·8364	·8424	·8484	·0061
115	30·8545	·8605	·8665	·8726	·8787	·8847	·8906	·8965	·9024	·9083	·0059
116	30·9142	·9200	·9259	·9317	·9375	·9433	·9490	·9548	·9605	·9663	·0058
117	30·9720	·9777	·9833	·9890	·9947	*·0003	*·0059	*·0115	*·0171	*·0227	·0056
118	31·0283	·0338	·0394	·0449	·0504	·0559	·0614	·0669	·0723	·0778	·0055
119	31·0832	·0886	·0940	·0994	·1048	·1101	·1154	·1208	·1261	·1314	·0054
120	31·1367	·1420	·1473	·1525	·1578	·1630	·1682	·1734	·1786	·1838	·0052
121	31·1889	·1941	·1992	·2043	·2095	·2146	·2196	·2247	·2298	·2348	·0051
122	31·2399	·2449	·2499	·2549	·2599	·2649	·2698	·2748	·2797	·2847	·0050
123	31·2896	·2945	·2994	·3043	·3091	·3140	·3188	·3237	·3285	·3333	·0049
124	31·3381	·3429	·3477	·3524	·3572	·3619	·3667	·3714	·3761	·3808	·0047
125	31·3855	·3902	·3948	·3995	·4041	·4088	·4134	·4180	·4226	·4272	·0046
126	31·4318	·4364	·4410	·4455	·4501	·4546	·4591	·4636	·4681	·4726	·0045
127	31·4771	·4816	·4860	·4905	·4949	·4993	·5038	·5082	·5126	·5170	·0044
128	31·5214	·5257	·5301	·5345	·5388	·5431	·5475	·5518	·5561	·5604	·0043
129	31·5647	·5690	·5732	·5775	·5818	·5860	·5902	·5945	·5987	·6029	·0042
130	31·6071	·6113	·6155	·6196	·6238	·6280	·6321	·6362	·6404	·6445	·0042
131	31·6486	·6527	·6568	·6609	·6650	·6690	·6731	·6772	·6812	·6852	·0041
132	31·6893	·6933	·6973	·7013	·7053	·7093	·7133	·7173	·7212	·7252	·0040
133	31·7291	·7331	·7370	·7410	·7449	·7488	·7527	·7566	·7605	·7644	·0039
134	31·7682	·7721	·7760	·7798	·7837	·7875	·7913	·7952	·7990	·8028	·0038
135	31·8066	·8104	·8142	·8179	·8217	·8255	·8292	·8330	·8367	·8405	·0038
136	31·8442	·8479	·8517	·8554	·8591	·8628	·8665	·8702	·8738	·8775	·0037
137	31·8812	·8848	·8885	·8921	·8958	·8994	·9030	·9067	·9103	·9139	·0036
138	31·9175	·9211	·9247	·9282	·9318	·9354	·9390	·9425	·9461	·9496	·0036
139	31·9532	·9567	·9602	·9638	·9673	·9708	·9743	·9778	·9813	·9848	·0035
140	31·9883	·9918	·9952	·9987	*·0022	*·0056	*·0091	*·0125	*·0160	*·0194	·0035
141	32·0228	·0263	·0297	·0331	·0365	·0399	·0433	·0467	·0501	·0535	·0034
142	32·0569	·0602	·0636	·0670	·0703	·0737	·0770	·0804	·0837	·0870	·0034
143	32·0904	·0937	·0970	·1003	·1036	·1069	·1102	·1135	·1168	·1201	·0033
144	32·1234	·1267	·1299	·1332	·1364	·1397	·1430	·1462	·1494	·1527	·0033
145	32·1559	·1591	·1624	·1656	·1688	·1720	·1752	·1784	·1816	·1848	·0032
146	32·1880	·1912	·1944	·1975	·2007	·2039	·2071	·2102	·2134	·2165	·0032
147	32·2197	·2228	·2260	·2291	·2322	·2354	·2385	·2416	·2447	·2478	·0031
148	32·2509	·2540	·2571	·2602	·2633	·2664	·2695	·2726	·2757	·2787	·0031
149	32·2818	·2849	·2879	·2910	·2940	·2971	·3001	·3032	·3062	·3093	·0030
150	32·3123	·3153	·3183	·3214	·3244	·3274	·3304	·3334	·3364	·3394	·0030
151	32·3424	·3454	·3484	·3514	·3543	·3573	·3603	·3633	·3662	·3692	·0030
152	32·3722	·3751	·3781	·3810	·3840	·3869	·3899	·3928	·3958	·3987	·0029
153	32·4016	·4046	·4075	·4104	·4133	·4162	·4192	·4221	·4250	·4279	·0029
154	32·4308	·4337	·4366	·4395	·4424	·4453	·4481	·4510	·4539	·4568	·0029
155	32·4597	·4625	·4654	·4683	·4711	·4740	·4768	·4797	·4825	·4854	·0029
156	32·4882	·4911	·4939	·4967	·4996	·5024	·5052	·5080	·5108	·5137	·0028
157	32·5165	·5193	·5221	·5249	·5277	·5305	·5333	·5361	·5389	·5416	·0028
158	32·5444	·5472	·5500	·5528	·5555	·5583	·5611	·5638	·5666	·5693	·0028
159	32·5721	·5748	·5776	·5803	·5831	·5858	·5885	·5913	·5940	·5967	·0027

A General Table of Values of $\frac{d^2}{w}t$ for Ogival-headed Shot.

v.	0	1	2	3	4	5	6	7	8	9	Diff.
f.s.	secs.	secs	secs.	secs.	secs.	secs.	secs.	secs.	secs.	secs.	
160	32·5994	·6022	·6049	·6076	·6103	·6130	·6157	·6184	·6211	·6238	·0027
161	32·6265	·6292	·6319	·6346	·6373	·6400	·6426	·6453	·6480	·6506	·0027
162	32·6533	·6560	·6586	·6613	·6640	·6666	·6693	·6719	·6745	·6772	·0026
163	32·6798	·6825	·6851	·6877	·6903	·6930	·6956	·6982	·7008	·7034	·0026
164	32·7061	·7087	·7113	·7139	·7165	·7191	·7217	·7243	·7268	·7294	·0026
165	32·7320	·7346	·7372	·7398	·7423	·7449	·7475	·7500	·7526	·7552	·0026
166	32·7577	·7603	·7628	·7654	·7679	·7705	·7730	·7756	·7781	·7806	·0025
167	32·7832	·7857	·7882	·7908	·7933	·7958	·7983	·8008	·8034	·8059	·0025
168	32·8084	·8109	·8134	·8159	·8184	·8209	·8234	·8258	·8283	·8308	·0025
169	32·8333	·8358	·8383	·8407	·8432	·8457	·8481	·8506	·8531	·8555	·0025
170	32·8580	·8604	·8629	·8653	·8678	·8702	·8726	·8751	·8775	·8799	·0024
171	32·8824	·8848	·8872	·8896	·8921	·8945	·8969	·8993	·9017	·9041	·0024
172	32·9065	·9089	·9113	·9137	·9161	·9185	·9209	·9233	·9257	·9281	·0024
173	32·9304	·9328	·9352	·9376	·9399	·9423	·9447	·9470	·9494	·9518	·0024
174	32·9541	·9565	·9588	·9612	·9635	·9659	·9682	·9705	·9729	·9752	·0023
175	32·9776	·9799	·9822	·9845	·9869	·9892	·9915	·9938	·9961	·9985	·0023
176	33·0008	·0031	·0054	·0077	·0100	·0123	·0146	·0169	·0192	·0215	·0023
177	33·0237	·0260	·0283	·0306	·0329	·0351	·0374	·0397	·0420	·0442	·0023
178	33·0465	·0488	·0510	·0533	·0555	·0578	·0600	·0623	·0645	·0668	·0023
179	33·0690	·0713	·0735	·0757	·0780	·0802	·0824	·0847	·0869	·0891	·0022
180	33·0913	·0935	·0958	·0980	·1002	·1024	·1046	·1068	·1090	·1112	·0022
181	33·1134	·1156	·1178	·1200	·1222	·1244	·1266	·1287	·1309	·1331	·0022
182	33·1353	·1375	·1396	·1418	·1440	·1461	·1483	·1505	·1526	·1548	·0022
183	33·1569	·1591	·1613	·1634	·1656	·1677	·1698	·1720	·1741	·1763	·0021
184	33·1784	·1805	·1827	·1848	·1869	·1891	·1912	·1933	·1954	·1975	·0021
185	33·1997	·2018	·2039	·2060	·2081	·2102	·2123	·2144	·2165	·2186	·0021
186	33·2207	·2228	·2249	·2270	·2291	·2312	·2333	·2353	·2374	·2395	·0021
187	33·2416	·2437	·2457	·2478	·2499	·2520	·2540	·2561	·2582	·2602	·0021
188	33·2623	·2643	·2664	·2685	·2705	·2726	·2746	·2767	·2787	·2808	·0021
189	33·2828	·2848	·2869	·2889	·2909	·2930	·2950	·2970	·2991	·3011	·0020
190	33·3031	·3051	·3072	·3092	·3112	·3132	·3152	·3172	·3192	·3212	·0020
191	33·3233	·3253	·3273	·3293	·3313	·3333	·3353	·3372	·3392	·3412	·0020
192	33·3432	·3452	·3472	·3492	·3511	·3531	·3551	·3571	·3590	·3610	·0020
193	33·3630	·3649	·3669	·3689	·3708	·3728	·3747	·3767	·3786	·3806	·0020
194	33·3825	·3845	·3864	·3884	·3903	·3922	·3942	·3961	·3980	·4000	·0019
195	33·4019	·4038	·4057	·4077	·4096	·4115	·4134	·4153	·4172	·4192	·0019
196	33·4211	·4230	·4249	·4268	·4287	·4306	·4325	·4344	·4362	·4381	·0019
197	33·4400	·4419	·4438	·4457	·4476	·4494	·4513	·4532	·4550	·4569	·0019
198	33·4588	·4606	·4625	·4644	·4662	·4681	·4699	·4718	·4736	·4755	·0019
199	33·4773	·4791	·4810	·4828	·4846	·4865	·4883	·4901	·4920	·4938	·0018
200	33·4956	·4974	·4992	·5010	·5028	·5047	·5065	·5083	·5101	·5119	·0018
201	33·5137	·5155	·5172	·5190	·5208	·5226	·5244	·5262	·5280	·5297	·0018
202	33·5315	·5333	·5351	·5368	·5386	·5404	·5421	·5439	·5456	·5474	·0018
203	33·5492	·5509	·5527	·5544	·5561	·5579	·5596	·5614	·5631	·5648	·0017
204	33·5666	·5683	·5700	·5717	·5735	·5752	·5769	·5786	·5803	·5820	·0017
205	33·5837	·5854	·5871	·5888	·5905	·5922	·5939	·5956	·5973	·5990	·0017
206	33·6007	·6024	·6040	·6057	·6074	·6091	·6107	·6124	·6141	·6157	·0017
207	33·6174	·6191	·6207	·6224	·6240	·6257	·6273	·6290	·6306	·6323	·0016
208	33·6339	·6355	·6372	·6388	·6404	·6420	·6437	·6453	·6469	·6485	·0016
209	33·6502	·6518	·6534	·6550	·6566	·6582	·6598	·6614	·6630	·6646	·0016
210	33·6662	·6678	·6694	·6710	·6726	·6741	·2757	·6773	·6789	·6805	·0016
211	33·6820	·6836	·6852	·6867	·6883	·6899	·6914	·6930	·6946	·6961	·0016
212	33·6977	·6992	·7008	·7023	·7039	·7054	·7070	·7085	·7100	·7116	·0015
213	33·7131	·7146	·7162	·7177	·7192	·7207	·7223	·7238	·7253	·7268	·0015
214	33·7283	·7298	·7313	·7329	·7344	·7359	·7374	·7389	·7404	·7419	·0015
215	33·7434	·7448	·7463	·7478	·7493	·7508	·7523	·7538	·7552	·7567	·0015
216	33·7582	·7597	·7612	·7626	·7641	·7656	·7670	·7685	·7700	·7714	·0015
217	33·7729	·7743	·7758	·7772	·7787	·7801	·7816	·7830	·7845	·7859	·0014
218	33·7874	·7888	·7902	·7917	·7931	·7945	·7960	·7976	·7988	·8002	·0014
219	33·8016	·8031	·8045	·8059	·8073	·8087	·8101	·8115	·8129	·8144	·0014

Appendix to Report VIII.—Table III—*continued.*

A General Table of Values of $\frac{d^2}{w}t$ for Ogival-headed Shot.

v.	0	1	2	3	4	5	6	7	8	9	Diff.
f.s.	secs.	secs.	secs.	secs.	secs.	secs.	secs.	secs.	secs.	secs.	
220	33·8158	·8172	·8186	·8200	·8214	·8227	·8241	·8255	·8269	·8283	·0014
221	33·8297	·8311	·8325	·8338	·8352	·8366	·8380	·8394	·8407	·8421	·0014
222	33·8435	·8448	·8462	·8476	·8489	·8503	·8517	·8530	·8544	·8557	·0014
223	33·8571	·8584	·8598	·8611	·8625	·8638	·8651	·8665	·8678	·8692	·0013
224	33·8705	·8718	·8732	·8745	·8758	·8772	·8785	·8798	·8811	·8824	·0013
225	33·8838	·8851	·8864	·8877	·8890	·8903	·8916	·8930	·8943	·8956	·0013
226	33·8969	·8982	·8995	·9008	·9021	·9034	·9046	·9059	·9072	·9085	·0013
227	33·9098	·9111	·9124	·9136	·9149	·9162	·9175	·9187	·9200	·9213	·0013
228	33·9226	·9238	·9251	·9264	·9276	·9289	·9301	·9314	·9326	·9339	·0013
229	33·9351	·9364	·9376	·9389	·9401	·9414	·9426	·9439	·9451	·9463	·0012
230	33·9476	·9488	·9500	·9513	·9525	·9537	·9550	·9562	·9574	·9586	·0012
231	33·9598	·9611	·9623	·9635	·9647	·9659	·9671	·9683	·9695	·9707	·0012
232	33·9719	·9732	·9744	·9756	·9768	·9779	·9791	·9803	·9815	·9827	·0012
233	33·9839	·9851	·9863	·9875	·9886	·9898	·9910	·9922	·9934	·9945	·0012
234	33·9957	·9969	·9981	·9992	*·0004	*·0016	*·0027	*·0039	*·0050	*·0062	·0012
235	34·0074	·0085	·0097	·0108	·0120	·0131	·0143	·0154	·0166	·0177	·0012
236	34·0189	·0200	·0212	·0223	·0234	·0246	·0257	·0268	·0280	·0291	·0011
237	34·0302	·0314	·0325	·0336	·0347	·0359	·0370	·0381	·0392	·0403	·0011
238	34·0414	·0426	·0437	·0448	·0459	·0470	·0481	·0492	·0503	·0514	·0011
239	34·0525	·0536	·0547	·0558	·0569	·0580	·0591	·0602	·0613	·0624	·0011
240	34·0635	·0645	·0656	·0667	·0678	·0689	·0700	·0710	·0721	·0732	·0011
241	34·0743	·0753	·0764	·0775	·0785	·0796	·0807	·0817	·0828	·0839	·0011
242	34·0849	·0860	·0870	·0881	·0892	·0902	·0913	·0923	·0934	·0944	·0011
243	34·0955	·0965	·0975	·0986	·0996	·1007	·1017	·1028	·1038	·1048	·0010
244	34·1059	·1069	·1079	·1090	·1100	·1110	·1120	·1131	·1141	·1151	·0010
245	34·1161	·1172	·1182	·1192	·1202	·1212	·1223	·1233	·1243	·1253	·0010
246	34·1263	·1273	·1283	·1293	·1303	·1313	·1323	·1333	·1343	·1353	·0010
247	34·1363	·1373	·1383	·1393	·1403	·1413	·1423	·1433	·1443	·1453	·0010
248	34·1463	·1472	·1482	·1492	·1502	·1512	·1521	·1531	·1541	·1551	·0010
249	34·1560	·1570	·1580	·1590	·1599	·1609	·1619	·1628	·1638	·1648	·0010

Appendix to Report VIII.—Table IV.

A General Table of Values of $\frac{d^2}{w}s$ for Ogival-headed Shot.

v.	0	1	2	3	4	5	6	7	8	9	Diff.
f.s.	feet.	feet.	feet.	feet.	feet.	feet.	feet.	feet.	feet.	feet.	
40	5000·0	5042·1	5084·1	5125·9	5167·7	5209·3	5250·8	5292·2	5333·5	5374·7	41·6
41	5415·7	5456·7	5497·5	5538·2	5578·8	5619·3	5659·6	5699·9	5740·0	5780·0	40·4
42	5819·9	5859·7	5889·4	5938·9	5978·4	6017·7	6057·0	6096·1	6135·1	6174·0	39·3
43	6212·8	6251·5	6290·1	6328·6	6367·0	6405·2	6443·4	6481·5	6519·4	6557·3	38·2
44	6595·0	6632·7	6670·2	6707·7	6745·0	6782·3	6819·5	6856·5	6893·5	6930·4	37·2
45	6967·2	7003·9	7040·5	7077·0	7113·4	7149·7	7186·0	7222·1	7258·2	7294·2	36·3
46	7330·1	7365·9	7401·6	7437·2	7472·8	7508·2	7543·6	7578·9	7614·2	7649·3	35·4
47	7684·4	7719·3	7754·2	7789·1	7823·8	7858·5	7893·1	7927·6	7962·0	7996·4	34·6
48	8030·7	8064·9	8099·0	8133·1	8167·1	8201·0	8234·8	8268·6	8302·3	8335·9	33·9
49	8369·5	8403·0	8436·4	8469·7	8503·0	8536·2	8569·4	8602·4	8635·5	8668·4	33·2
50	8701·3	8734·1	8766·8	8799·5	8832·1	8864·7	8897·2	8929·6	8961·9	8994·2	32·5
51	9026·4	9058·6	9090·7	9122·7	9154·7	9186·6	9218·4	9250·2	9281·9	9313·6	31·9
52	9345·2	9376·7	9408·2	9439·6	9471·0	9502·3	9533·5	9564·7	9595·8	9626·9	31·3
53	9657·9	9688·9	9719·8	9750·6	9781·4	9812·1	9842·8	9873·4	9904·0	9934·5	30·7
54	9965·0	9995·4	0025·7	0056·0	0086·3	0116·4	0146·6	0176·7	0206·7	0236·6	30·2
55	10266·6	0296·4	0326·2	0356·0	0385·7	0415·4	0445·0	0474·5	0504·0	0533·4	29·6
56	10562·8	0592·2	0621·5	0650·7	0679·9	0709·1	0738·2	0767·2	0796·2	0825·2	29·1
57	10854·1	0883·0	0911·8	0940·6	0969·3	0998·0	1026·7	1055·3	1083·8	1112·4	28·7
58	11140·8	1169·2	1197·6	1226·0	1254·3	1282·5	1310·8	1339·0	1367·1	1395·2	28·3
59	11423·3	1451·3	1479·3	1507·3	1535·2	1563·0	1590·9	1618·7	1646·4	1674·2	27·9
60	11701·8	1729·5	1757·1	1784·6	1812·2	1839·6	1867·1	1894·5	1921·9	1949·2	27·5
61	11976·5	2003·7	2031·0	2058·1	2085·3	2112·4	2139·4	2166·4	2193·4	2220·4	27·1
62	12247·3	2274·2	2301·0	2327·8	2354·5	2381·3	2407·9	2434·6	2461·2	2487·7	26·7
63	12514·3	2540·8	2567·2	2593·6	2620·0	2646·3	2672·6	2698·9	2725·1	2751·3	26·3
64	12777·5	2803·6	2829·7	2855·7	2881·7	2907·7	2933·7	2959·6	2985·4	3011·2	26·0
65	13037·0	3062·8	3088·5	3114·2	3139·8	3165·4	3191·0	3216·5	3242·0	3267·4	25·6
66	13292·8	3318·2	3343·5	3368·8	3394·1	3419·3	3444·5	3469·6	3494·7	3519·8	25·2
67	13544·8	3569·8	3594·8	3619·8	3644·7	3669·5	3694·3	3719·1	3743·9	3768·6	24·8
68	13793·3	3818·0	3842·6	3867·2	3891·7	3916·2	3940·7	3965·2	3989·6	4014·0	24·5
69	14038·4	4062·7	4087·0	4111·3	4135·6	4159·8	4184·0	4208·1	4232·2	4256·3	24·2
70	14280·4	4304·5	4328·5	4352·4	4376·4	4400·3	4424·1	4448·0	4471·8	4495·5	23·9
71	14519·3	4543·0	4566·6	4590·2	4613·8	4637·4	4660·9	4684·4	4707·8	4731·3	23·5
72	14754·7	4777·9	4801·3	4824·6	4847·9	4871·1	4894·2	4917·4	4940·5	4963·6	23·2
73	14986·6	5009·6	5032·6	5055·5	5078·4	5101·3	5124·1	5146·9	5169·6	5192·4	22·8
74	15215·1	5237·7	5260·3	5282·9	5305·5	5328·0	5350·5	5373·0	5395·4	5417·8	22·5
75	15440·2	5462·5	5484·8	5507·1	5529·3	5551·5	5573·7	5595·8	5617·9	5640·0	22·2
76	15662·1	5684·1	5706·0	5728·0	5749·9	5771·7	5793·5	5815·3	5837·0	5858·7	21·8
77	15880·4	5902·0	5923·6	5945·1	5966·6	5988·1	6009·5	6030·9	6052·2	6073·6	21·5
78	16094·8	6116·1	6137·3	6158·4	6179·6	6200·7	6221·7	6242·7	6263·7	6284·6	21·1
79	16305·5	6326·4	6347·2	6368·0	6388·8	6409·5	6430·2	6450·8	6471·4	6492·0	20·7
80	16512·6	6533·1	6553·6	6574·0	6594·4	6614·8	6635·1	6655·4	6675·7	6695·9	20·4
81	16716·1	6736·3	6756·4	6776·5	6796·5	6816·5	6836·5	6856·4	6876·3	6896·1	20·0
82	16916·0	6935·7	6955·5	6975·1	6994·8	7014·4	7033·9	7053·4	7072·9	7092·3	19·6
83	17111·7	7131·0	7150·3	7169·6	7188·8	7207·9	7227·1	7246·1	7265·2	7284·1	19·1
84	17303·1	7322·0	7340·8	7359·6	7378·4	7397·1	7415·8	7434·4	7453·0	7471·5	18·7
85	17490·0	7508·5	7526·9	7545·3	7563·6	7581·8	7600·0	7618·2	7636·3	7654·4	18·2
86	17672·4	7690·5	7708·4	7726·4	7744·2	7762·0	7779·9	7797·6	7815·4	7833·0	17·8
87	17850·6	7868·2	7885·8	7903·3	7920·8	7938·2	7955·6	7973·0	7990·3	8007·6	17·4
88	18024·8	8042·0	8059·2	8076·3	8093·4	8110·4	8127·4	8144·4	8161·3	8178·2	17·0
89	18195·0	8211·9	8228·6	8245·4	8262·1	8278·7	8295·4	8312·0	8328·5	8345·0	16·6
90	18361·5	8377·9	8394·3	8410·7	8427·0	8443·3	8459·6	8475·8	8492·0	8508·2	16·3
91	18524·3	8540·4	8556·4	8572·4	8588·4	8604·3	8620·3	8636·1	8652·0	8667·8	15·9
92	18683·5	8699·3	8715·0	8730·7	8746·3	8761·9	8777·5	8793·0	8808·5	8824·0	15·6
93	18839·4	8854·8	8870·2	8885·5	8900·8	8916·1	8931·3	8946·5	8961·7	8976·8	15·3
94	18991·9	9007·0	9022·0	9037·0	9052·0	9066·9	9081·9	9096·7	9111·6	9126·4	15·0
95	19141·2	9156·0	9170·7	9185·4	9200·1	9214·7	9229·3	9243·9	9258·4	9272·9	14·6
96	19287·4	9301·9	9316·3	9330·7	9345·0	9359·4	9373·7	9387·9	9402·2	9416·4	14·3
97	19430·6	9444·7	9458·9	9473·0	9487·0	9501·1	9515·1	9529·1	9543·0	9557·0	14·0
98	19570·8	9584·7	9598·6	9612·4	9626·1	9639·9	9653·6	9667·3	9681·0	9694·6	13·7
99	19708·3	9721·9	9735·4	9749·0	9762·5	9775·9	9789·4	9802·8	9816·2	9829·6	13·5

APPENDIX TO REPORT VIII.—TABLE IV—*continued*

A General Table of Values of $\frac{d^2}{w}s$ for Ogival-headed Shot.

v.	0	1	2	3	4	5	6	7	8	9	Diff.
f.s.	feet.	feet.	feet.	feet.	feet.	feet.	feet.	feet.	feet.	feet.	
100	19842·9	9856·3	9869·6	9882·9	9896·1	9909·3	9922·5	9935·7	9948·8	9961·9	13·2
101	19975·0	9988·1	0001·1	0014·1	0027·1	0040·0	0052·9	0065·8	0078·7	0091·5	12·9
102	20104·3	0117·1	0129·8	0142·5	0155·2	0167·8	0180·4	0192·9	0205·4	0217·8	12·6
103	20230·1	0242·4	0254·6	0266·8	0278·8	0290·8	0302·7	0314·5	0326·2	0337·8	11·9
104	20349·4	0360·8	0372·2	0383·4	0394·5	0405·6	0416·5	0427·3	0438·1	0448·7	11·0
105	20459·2	0469·6	0479·9	0490·0	0500·1	0510·1	0520·0	0529·8	0539·5	0549·2	9·9
106	20558·7	0568·2	0577·6	0586·9	0596·2	0605·4	0614·5	0623·6	0632·6	0641·6	9·2
107	20650·5	0659·3	0668·1	0676·9	0685·6	0694·2	0702·8	0711·4	0719·9	0728·4	8·6
108	20736·8	0745·2	0753·6	0761·9	0770·2	0778·4	0786·6	0794·8	0802·9	0811·0	8·2
109	20819·0	0827·1	0835·0	0843·0	0850·9	0858·9	0866·7	0874·6	0882·4	0890·2	7·9
110	20897·9	0905·7	0913·4	0921·1	0928·7	0936·4	0944·0	0951·5	0959·1	0966·6	7·6
111	20974·2	0981·6	0989·1	0996·6	1004·0	1011·4	1018·8	1026·2	1033·5	1040·9	7·4
112	21048·2	1055·5	1062·8	1070·0	1077·3	1084·5	1091·7	1099·0	1106·1	1113·3	7·2
113	21120·5	1127·6	1134·8	1141·9	1149·0	1156·1	1163·2	1170·2	1177·3	1184·4	7·1
114	21191·4	1198·4	1205·4	1212·4	1219·4	1226·4	1233·3	1240·3	1247·2	1254·1	7·0
115	21261·0	1267·9	1274·8	1281·7	1288·6	1295·4	1302·3	1309·1	1315·9	1322·7	6·8
116	21329·5	1336·3	1343·1	1349·8	1356·6	1363·3	1370·0	1376·7	1383·4	1390·1	6·7
117	21396·8	1403·5	1410·1	1416·8	1423·4	1430·0	1436·6	1443·2	1449·8	1456·4	6·6
118	21462·9	1469·5	1476·0	1482·6	1489·1	1495·6	1502·1	1508·6	1515·1	1521·5	6·5
119	21528·0	1534·4	1540·9	1547·3	1553·7	1560·1	1566·5	1572·9	1579·2	1585·6	6·4
120	21591·9	1598·3	1604·6	1610·9	1617·2	1623·5	1629·8	1636·1	1642·3	1648·6	6·3
121	21654·8	1661·1	1667·3	1673·5	1679·7	1685·9	1692·1	1698·2	1704·4	1710·5	6·2
122	21716·7	1722·8	1728·9	1735·0	1741·1	1747·2	1753·3	1759·4	1765·4	1771·5	6·1
123	21777·5	1783·6	1789·6	1795·6	1801·6	1807·6	1813·6	1819·6	1825·6	1831·5	6·0
124	21837·5	1843·4	1849·4	1855·3	1861·2	1867·1	1873·0	1878·9	1884·8	1890·6	5·9
125	21896·5	1902·3	1908·2	1914·0	1919·8	1925·6	1931·5	1937·3	1943·0	1948·8	5·8
126	21954·6	1960·4	1966·1	1971·9	1977·6	1983·3	1989·0	1994·8	2000·5	2006·2	5·7
127	22011·8	2017·5	2023·2	2028·9	2034·5	2040·2	2045·8	2051·4	2057·0	2062·7	5·6
128	22068·3	2073·9	2079·5	2085·0	2090·6	2096·2	2101·8	2107·3	2112·9	2118·4	5·6
129	22123·9	2129·4	2135·0	2140·5	2146·0	2151·5	2157·0	2162·4	2167·9	2173·4	5·5
130	22178·8	2184·3	2189·7	2195·1	2200·6	2206·0	2211·4	2216·8	2222·2	2227·6	5·4
131	22233·0	2238·4	2243·7	2249·1	2254·5	2259·8	2265·1	2270·5	2275·8	2281·1	5·3
132	22286·4	2291·8	2297·1	2302·4	2307·6	2312·9	2318·2	2323·5	2328·7	2334·0	5·3
133	22339·2	2344·5	2349·7	2355·0	2360·2	2365·4	2370·6	2375·8	2381·0	2386·2	5·2
134	22391·4	2396·6	2401·8	2406·9	2412·1	2417·3	2422·4	2427·6	2432·7	2437·8	5·2
135	22443·0	2448·1	2453·2	2458·3	2463·4	2468·5	2473·6	2478·7	2483·8	2488·9	5·1
136	22493·9	2499·0	2504·1	2509·1	2514·2	2519·2	2524·3	2529·3	2534·3	2539·4	5·0
137	22544·4	2549·4	2554·4	2559·4	2564·4	2569·4	2574·4	2579·4	2584·3	2589·3	5·0
138	22594·3	2599·2	2604·2	2609·1	2614·1	2619·0	2624·0	2628·9	2633·8	2638·8	4·9
139	22643·7	2648·6	2653·5	2658·4	2663·3	2668·2	2673·1	2678·0	2682·9	2687·8	4·9
140	22692·6	2697·5	2702·4	2707·2	2712·1	2717·0	2721·8	2726·7	2731·5	2736·3	4·9
141	22741·2	2746·0	2750·8	2755·7	2760·5	2765·3	2770·1	2774·9	2779·7	2784·5	4·8
142	22789·3	2794·1	2798·9	2803·7	2808·5	2813·2	2818·0	2822·8	2827·5	2832·3	4·8
143	22837·1	2841·8	2846·6	2851·3	2856·0	2860·8	2865·5	2870·2	2875·0	2879·7	4·7
144	22884·4	2889·1	2893·8	2898·6	2903·3	2908·0	2912·7	2917·4	2922·1	2926·7	4·7
145	22931·4	2936·1	2940·8	2945·5	2950·1	2954·8	2959·5	2964·1	2968·8	2973·5	4·7
146	22978·1	2982·8	2987·4	2992·1	2996·7	3001·3	3006·0	3010·6	3015·2	3019·9	4·6
147	23024·5	3029·1	3033·7	3038·4	3043·0	3047·6	3052·2	3056·8	3061·4	3066·0	4·6
148	23070·6	3075·2	3079·8	3084·4	3089·0	3093·5	3098·1	3102·7	3107·3	3111·8	4·6
149	23116·4	3121·0	3125·6	3130·1	3134·7	3139·2	3143·8	3148·3	3152·9	3157·4	4·6
150	23162·0	3166·5	3171·0	3175·6	3180·1	3184·6	3189·2	3193·7	3198·2	3202·7	4·5
151	23207·2	3211·8	3216·3	3220·8	3225·3	3229·8	3234·3	3238·8	3243·3	3247·8	4·5
152	23252·3	3256·8	3261·3	3265·8	3270·3	3274·8	3279·3	3283·8	3288·3	3292·8	4·5
153	23297·2	3301·7	3306·2	3310·6	3315·1	3319·6	3324·1	3328·5	3333·0	3337·5	4·5
154	23342·0	3346·4	3350·9	3355·3	3359·8	3364·3	3368·7	3373·2	3377·6	3382·1	4·5
155	23386·5	3391·0	3395·4	3399·9	3404·3	3408·7	3413·2	3417·6	3422·0	3426·5	4·4
156	23430·9	3435·3	3439·8	3444·2	3448·6	3453·0	3457·4	3461·9	3466·3	3470·7	4·4
157	23475·1	3479·5	3483·9	3488·3	3492·7	3497·1	3501·5	3505·9	3510·3	3514·7	4·4
158	23519·1	3523·5	3527·9	3532·3	3536·7	3541·1	3545·4	3549·8	3554·2	3558·6	4·4
159	23563·0	3567·3	3571·7	3576·1	3580·4	3584·8	3589·1	3593·5	3597·9	3602·2	4·4

Appendix to Report VIII.—Table IV—*continued.*

A General Table of Values of $\frac{d^2}{w}s$ for Ogival-headed Shot.

v.	0	1	2	3	4	5	6	7	8	9	Diff.
f.s.	feet.	feet.	feet.	feet.	feet.	feet.	feet.	feet.	feet.	feet.	
160	23606·6	3610·9	3615·3	3619·6	3624·0	3628·3	3632·6	3637·0	3641·3	3645·7	4·3
161	23650·0	3654·3	3658·7	3663·0	3667·3	3671·6	3676·0	3680·3	3684·6	3688·9	4·3
162	23693·3	3697·6	3701·9	3706·2	3710·5	3714·8	3719·1	3723·4	3727·7	3732·0	4·3
163	23736·3	3740·6	3744·9	3749·2	3753·5	3757·8	3762·1	3766·4	3770·6	3774·9	4·3
164	23779·2	3783·5	3787·8	3792·0	3796·3	3800·6	3804·9	3809·1	3813·4	3817·6	4·3
165	23821·9	3826·2	3830·4	3834·7	3838·9	3843·2	3847·4	3851·7	3855·9	3860·2	4·3
166	23864·4	3868·7	3872·9	3877·2	3881·4	3885·6	3889·9	3894·1	3898·3	3902·5	4·2
167	23906·8	3911·0	3915·2	3919·5	3923·7	3927·9	3932·1	3936·3	3940·5	3944·7	4·2
168	23949·0	3953·2	3957·4	3961·6	3965·8	3970·0	3974·2	3978·4	3982·6	3986·7	4·2
169	23990·9	3995·1	3999·3	4003·5	4007·7	4011·9	4016·0	4020·2	4024·4	4028·6	4·2
170	24032·7	4036·9	4041·1	4045·2	4049·4	4053·6	4057·7	4061·9	4066·0	4070·2	4·2
171	24074·3	4078·5	4082·6	4086·8	4090·9	4095·1	4099·2	4103·3	4107·5	4111·6	4·1
172	24115·7	4119·9	4124·0	4128·1	4132·3	4136·4	4140·5	4144·6	4148·7	4152·9	4·1
173	24157·0	4161·1	4165·2	4169·3	4173·4	4177·5	4181·6	4185·7	4189·8	4193·9	4·1
174	24198·0	4202·1	4206·2	4210·3	4214·4	4218·5	4222·6	4226·7	4230·8	4234·8	4·1
175	24238·9	4243·0	4247·1	4251·2	4255·3	4259·3	4263·4	4267·5	4271·5	4275·6	4·1
176	24279·6	4283·7	4287·8	4291·8	4295·9	4300·0	4304·0	4308·0	4312·1	4316·1	4·1
177	24320·2	4324·2	4328·3	4332·3	4336·4	4340·4	4344·4	4348·5	4352·5	4356·5	4·0
178	24360·5	4364·6	4368·6	4372·6	4376·6	4380·7	4384·7	4388·7	4392·7	4396·7	4·0
179	24400·7	4404·7	4408·8	4412·8	4416·8	4420·8	4424·8	4428·8	4432·8	4436·8	4·0
180	24440·8	4444·7	4448·7	4452·7	4456·7	4460·7	4464·7	4468·7	4472·6	4476·6	4·0
181	24480·6	4484·6	4488·5	4492·5	4496·5	4500·5	4504·4	4508·4	4512·4	4516·3	4·0
182	24520·3	4524·2	4528·2	4532·2	4536·1	4540·1	4544·0	4548·0	4551·9	4555·9	4·0
183	24559·8	4563·7	4567·7	4571·6	4575·6	4579·5	4583·4	4587·4	4591·3	4595·2	3·9
184	24599·2	4603·1	4607·0	4610·9	4614·9	4618·8	4622·7	4626·6	4630·5	4634·4	3·9
185	24638·4	4642·3	4646·2	4650·1	4654·0	4657·9	4661·8	4665·7	4669·6	4673·5	3·9
186	24677·4	4681·3	4685·2	4689·1	4693·0	4696·9	4700·8	4704·6	4708·5	4712·4	3·9
187	24716·3	4720·2	4724·1	4727·9	4731·8	4735·7	4739·6	4743·4	4747·3	4751·2	3·9
188	24755·0	4758·9	4762·8	4766·7	4770·5	4774·4	4778·2	4782·1	4786·0	4789·8	3·9
189	24793·7	4797·5	4801·4	4805·2	4809·1	4812·9	4816·8	4820·6	4824·5	4828·3	3·8
190	24832·2	4836·0	4839·8	4843·7	4847·5	4851·4	4855·2	4859·0	4862·8	4866·7	3·8
191	24870·5	4874·3	4878·1	4882·0	4885·8	4889·6	4893·4	4897·3	4901·1	4904·9	3·8
192	24908·7	4912·5	4916·3	4920·1	4923·9	4927·7	4931·5	4935·3	4939·1	4942·9	3·8
193	24946·7	4950·5	4954·3	4958·1	4961·9	4965·7	4969·4	4973·2	4977·0	4980·7	3·8
194	24984·5	4988·3	4992·1	4995·8	4999·6	5003·4	5007·1	5010·9	5014·7	5018·4	3·8
195	25022·2	5025·9	5029·7	5033·4	5037·2	5040·9	5044·7	5048·4	5052·1	5055·9	3·7
196	25059·6	5063·4	5067·1	5070·8	5074·6	5078·3	5082·0	5085·7	5089·4	5093·1	3·7
197	25096·9	5100·6	5104·3	5108·0	5111·7	5115·4	5119·1	5122·8	5126·5	5130·2	3·7
198	25133·9	5137·5	5141·2	5144·9	5148·6	5152·3	5156·0	5159·6	5163·3	5166·9	3·7
199	25170·6	5174·3	5177·9	5181·6	5185·2	5188·9	5192·5	5196·2	5199·8	5203·4	3·6
200	25207·1	5210·7	5214·3	5218·0	5221·6	5225·2	5228·8	5232·5	5236·1	5239·7	3·6
201	25243·3	5246·9	5250·5	5254·1	5257·7	5261·3	5264·9	5268·5	5272·1	5275·7	3·6
202	25279·2	5282·8	5286·4	5290·0	5293·6	5297·2	5300·7	5304·3	5307·8	5311·4	3·6
203	25314·9	5318·5	5322·0	5325·6	5329·1	5332·7	5336·2	5339·7	5343·3	5346·8	3·5
204	25350·3	5353·8	2357·3	5360·9	5364·4	5367·9	5371·4	5374·9	5378·4	5381·9	3·5
205	25385·4	5388·9	5392·4	5395·9	5399·4	5402·9	5406·3	5409·8	5413·3	5416·7	3·5
206	25420·2	5423·7	5427·1	5430·6	5434·1	5437·5	5441·0	5444·4	5447·8	5451·3	3·5
207	25454·7	5458·1	5461·6	5465·0	5468·4	5471·9	5475·3	5478·7	5482·1	5485·5	3·4
208	25488·9	5492·3	5495·7	5499·1	5502·5	5505·9	5509·3	5512·7	5516·1	5519·4	3·4
209	25522·8	5526·2	5529·6	5532·9	5536·3	5539·7	5543·0	5546·4	5549·7	5553·1	3·4
210	25556·4	5559·8	5563·1	5566·4	5569·8	5573·1	5576·5	5579·8	5583·1	5586·4	3·3
211	25589·7	5593·0	5596·4	5599·7	5603·0	5606·3	5609·6	5612·9	5616·2	5619·5	3·3
212	25622·8	5626·1	5629·3	5632·6	5635·9	5639·2	5642·5	5645·7	5649·0	5652·3	3·3
213	25655·5	5658·8	5662·0	5665·3	5668·6	5671·8	5675·1	5678·3	5681·5	5684·8	3·2
214	25688·0	5691·2	5694·5	5697·7	5700·9	5704·2	5707·4	5710·6	5713·8	5717·0	3·2
215	25720·2	5723·4	5726·6	5729·9	5733·1	5736·3	5739·5	5742·6	5745·8	5749·0	3·2
216	25752·2	5755·4	5758·6	5761·8	5764·9	5768·1	5771·3	5774·4	5777·6	5780·8	3·2
217	25783·9	5787·1	5790·2	5793·4	5796·6	5799·7	5802·9	5806·0	5809·1	5812·2	3·1
218	25815·4	5818·5	5821·6	5824·8	5827·9	5831·0	5834·1	5837·3	5840·4	5843·5	3·1
219	25846·6	5849·7	5852·8	5855·9	5859·0	5862·1	5865·2	5868·3	5871·4	5874·4	3·1

A General Table of Values of $\frac{d^3}{w}s$ for Ogival-headed Shot.

v.	0	1	2	3	4	5	6	7	8	9	Diff.
f.s.	feet.	feet.	feet.	feet.	feet.	feet.	feet.	feet.	feet.	feet.	
220	25877·5	5880·6	5883·7	5886·8	5889·9	5893·0	5896·0	5899·1	5902·1	5905·2	3·1
221	25908·3	5911·3	5914·4	5917·4	5920·5	5923·6	5926·6	5929·6	5932·7	5935·7	3·0
222	25938·7	5941·8	5944·8	5947·8	5950·9	5953·9	5956·9	5959·9	5963·0	5966·0	3·0
223	25969·0	5972·0	5975·0	5978·0	5981·0	5984·0	5987·0	5990·0	5993·0	5996·0	3·0
224	25999·0	6002·0	6004·9	6007·9	6010·9	6013·9	6016·9	6019·8	6022·8	6025·8	3·0
225	26028·7	6031·7	6034·7	6037·6	6040·6	6043·6	6046·5	6049·5	6052·4	6055·3	3·0
226	26058·3	6061·2	6064·2	6067·1	6070·0	6073·0	6075·9	6078·8	6081·7	6084·6	2·9
227	26087·5	6090·5	6093·4	6096·3	6099·2	6102·1	6105·0	6107·9	6110·8	6113·7	2·9
228	26116·6	6119·4	6122·3	6125·2	6128·1	6131·0	6133·9	6136·7	6139·6	6142·5	2·9
229	26145·3	6148·2	6151·0	6153·9	6156·8	6159·6	6162·5	6165·3	6168·1	6171·0	2·9
230	26173·8	6176·7	6179·5	6182·3	6185·2	6188·0	6190·8	6193·6	6196·5	6199·3	2·8
231	26202·1	6204·9	6207·7	6210·5	6213·3	6216·2	6218·9	6221·7	6224·5	6227·3	2·8
232	26230·1	6232·9	6235·7	6238·5	6241·3	6244·1	6246·8	6249·6	6252·3	6255·1	2·8
233	26257·9	6260·6	6263·4	6266·2	6268·9	6271·7	6274·5	6277·2	6279·9	6282·7	2·8
234	26285·4	6288·2	6290·9	6293·7	6296·4	6299·1	6301·9	6304·6	6307·3	6310·0	2·7
235	26312·7	6315·5	6318·2	6320·9	6323·6	6326·3	6329·0	6331·7	6334·4	6337·1	2·7
236	26339·8	6342·5	6345·2	6347·9	6350·6	6353·3	6356·0	6358·6	6361·3	6364·0	2·7
237	26366·7	6369·3	6372·0	6374·7	6377·3	6380·0	6382·7	6385·3	6388·0	6390·6	2·7
238	26393·3	6395·9	6398·6	6401·2	6403·9	6406·5	6409·2	6411·8	6414·4	6417·1	2·6
239	26419·7	6422·3	6424·9	6427·6	6430·2	6432·8	6435·4	6438·0	6440·7	6443·3	2·6
240	26445·9	6448·5	6451·1	6453·7	6456·3	6458·9	6461·5	6464·1	6466·7	6469·2	2·6
241	26471·8	6474·4	6477·0	6479·6	6482·2	6484·8	6487·3	6489·9	6492·4	6495·0	2·6
242	26497·6	6500·1	6502·7	6505·3	6507·8	6510·4	6512·9	6515·5	6518·0	6520·6	2·6
243	26523·1	6525·6	6528·2	6530·7	6533·3	6535·8	6538·3	6540·9	6543·4	6545·9	2·5
244	26548·4	6550·9	6553·5	6556·0	6558·5	6561·0	6563·5	6566·0	6568·5	6571·0	2·5
245	26573·5	6576·0	6578·5	6581·0	6583·5	6586·1	6588·5	6591·0	6593·5	6596·0	2·5
246	26598·5	6600·9	6603·4	6605·9	6608·4	6610·9	6613·3	6615·8	6618·2	6620·7	2·5
247	26623·2	6625·6	6628·1	6630·5	6633·0	6635·5	6637·9	6640·4	6642·8	6645·2	2·5
248	26647·7	6650·1	6652·6	6655·0	6657·4	6659·9	6662·3	6664·7	6667·1	6669·6	2·4
249	26672·0	6674·4	6676·8	6679·3	6681·7	6684·1	6686·5	6688·9	6691·3	6693·7	2·4